The Electrical Review

VOL. CVIII MAY 1, 1931 No. 2788

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872

Published every FRIDAY, Price 6d.

THE ELECTRICAL REVIEW 4 LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT, LONDON." Code, A B C. Telephone No.: Central 5871 (5 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades and has by far the largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom £1 14s. 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to E.R. (1930) LTD., and crossed "Lloyds Bank, Law Courts Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement

Contents:

	PAGE
Census or Register?	737
Gasfilled Lamp Prices	738
Interest the Children	738
Research Rationalisation	738
The Buenos Aires Exhibition	738
Aylesbury's Progress	738
Metropolitan-Vickers and Russia	738
The Weir Report, by Sir Philip Dawson	739
A New Radio Receiver	740
The New Vancouver Showrooms, by F. H. Fullerton *(illus.)*	741
The Railway Report	744
The Faraday Commemoration at Battersea	745
Transformer Protection, by D. A. Bower *(illus.)*	746
Slip-ring Maintenance *(illus.)*	747
Rheostatic Tram-car Braking *(illus.)*	747
The September Celebrations	748
Business and Industrial Notes	750
Electricity Supply	754
Traction	756
Telegraph and Telephone	756
Radio	756
Contract Information	757
Forthcoming Events	758
Notes	758
Our Personal Column	760
Financial Section—	
New Companies Registered	761
Official Returns of Electrical Companies	761
Financial Section—*contd.*	
City Notes	762
Stocks and Shares	763
Registered Electrical Contractors	765
Trade Prospects in Brazil	765
Notes from Canada	766
New Apparatus and Devices	767
A Large Electro-magnet *(illus.)*	768
The Societies and their Doings	769
The Eddy-current Rail Brake *(illus.)*	771
The "Ionic Wind" Voltmeter	771
Enterprise at Aylesbury *(illus.)*	772
Parliamentary Notes	772
Correspondence—	
Yearly Contract Schedules	773
Adaptable Electric Motors	773
Breakdown Insurances	773
Leakage Trips on 100-A Circuits	773
Motor Impregnation	774
The School of Electrical Engineering	774
David and Goliath	774
Use Bakelite	774
Petrol-electric Vehicles	775
Engineering Degrees	775
Phase Shifters	775
Published Specifications	775
Trade Mark Applications	775
New Work for Contractors	776

Census or Register?

ELECTRICAL contractors form one of the most important sections of the industry, and we believe that numerically they are the largest.

Many estimates have been made of their actual number, but where such wide variations exist in the qualifications of those claiming to be included in the trade, little agreement has been reached.

Several years ago when it was necessary to form a rough estimate for propaganda purposes in accelerating the rate of domestic development, a round figure of 12,000 was stated, but when the modern Gideon sorted out this impressive host it was found that only about 6,000 remained as men who really mattered.

What will last Sunday's Census reveal on this point? It will not discriminate between the good and the bad: the qualified and the unqualified; the Registered and the unregistered, but if all who profess and call themselves electrical contractors properly record their claim, the Registrar should have some very interesting statistics for us!

There will, of course, be plenty of questioning again afterwards as to what constitutes an electrical contractor; whether an electrical dealer, a retailer, or a small shopkeeper; an ironmonger or a hardwareman; a building contractor or a big West End store should be permitted to appear in so select a class. But we shall at any rate be furnished with an up-to-date figure of those who are doing, or who claim to be doing, electrical work, whether good or bad, and selling electrical goods—whether British or foreign. We may likewise learn how large is the army of electrical wiremen constantly engaged on installation work—be they Union or non-union; this, again, it should be quite useful to know.

The policy of this journal has always been in favour of any movement that would produce safe and sound installation work, but it has never spurned the services of the small man merely because he has been a small man. Many of the big men of to-day in the contracting world once started in a small way, and they would be the first to admit it. But we have a Register set up by the whole industry, admission to which is supposed to carry a guarantee of efficient work. We have an annual census prepared for us regarding this organisation. Last year out of the estimated 12,000 or 6,000 mentioned above, 262 new applicants came forward, but so strict must be the rules in order to maintain the high standard of membership, that so far only 122 have been accepted, while 69 were actually refused. The position at the close of 1930 revealed a total of 1,380 on the Register, and the number at this date is 1,411.

Just what is happening is shown on another page of this issue. The Executive Committee deserves our thanks for the performance of very difficult and responsible duties. It not only has to consider claims from new firms, but it has to investigate complaints made

against existing members. If the Register is to continue to hold a high reputation throughout the Kingdom such investigation must be more fully carried out. In nineteen cases during 1930 something was found to be wrong, and whether members were removed or whether they were only "cautioned," the need for more extensive inspection of work is obvious, and the Committee recognises the fact.

There seems to be some doubt in the minds of the Committee as to the possible aggregate number of the registered. We can hardly imagine that 1,410 members is "saturation point." Mr. Purse puts the number of eligible contractors at 2,000.

How vast, then, is the army of the ineligible, if the grand total of claimants to be electrical contractors is anywhere near the figures already mentioned.

Gasfilled Lamp Prices

ELECTRIC lamp matters just now possess a greater interest than usual for the trade, and for other people, too, judging from the variety of inquiries that are being "put through" to the editors just now. The interest is due to expectation of developments following the expiration of the gasfilled lamp patent, for which a two years' extension was granted in May, 1929. For some time past there have been rumours of an extensive gasfilled lamp-selling campaign, organised by foreign interests and importing concerns. The intention of a well-known British company, not in the lamp-makers' association, to make gasfilled lamps has been announced and price-lists have been prepared. Some rumours circulated in the financial Press regarding other intentions of this company are not confirmed. The main thing that emerges from all our efforts in search of information is the list of reduced prices issued by E.L.M.A., on behalf of its members, and advertised in our other pages to-day.

Interest the Children

ELECTRICAL interest for children in the supply undertaking showroom is an idea received from the article this week describing the new showrooms at Vancouver, British Columbia. It is a good idea, and is worth the serious consideration of all supply engineers. For some time now the E.D.A., the E.A.W. and other important organisations in the electrical industry, and also eminent electrical men, have strongly advocated electrical educational propaganda among children by various means. Here is a scheme which should prove a very effective way to instil in the young mind the "electric idea." It is of particular interest that the suggestion lends itself especially to the domestic side. It is not difficult to imagine the impression which would be made on a young school girl by attractive "play-time" demonstrations and displays of "utility toys," such as cookers, kettles, toasters, irons, and so on. Very many adults will never become electrical cooking and heating consumers merely because they saw nothing but gas usage during their upbringing. See to it that the young generation has every opportunity to, at least *see it done* electrically.

Research Rationalisation

SHOULD research be rationalised? asks Mr. H. H. Taylour in the I.E.E. students' quarterly journal. Whilst admitting the fundamental necessity for research and conceding very nearly level suspension of the balance of achievement between industrial investigation (in which money is rarely deemed to have been well spent if it does not bring tangible results fairly quickly) and college and laboratory theoretical performance (which does not seek financial reward), he is struck by the large amount of research which he characterises as "far in advance of present needs and unlikely to yield useful information." Evidence of a tendency to reverse the old order of the practical aspect preceding the theoretical one is considered to be curious and not altogether desirable, in the electrical industry at any rate. There is, in the author's opinion, far too much haphazard theory, which will not bear the test of time from the point of view of practice, and he fears that investigation into matters which will not be of immediate utility will incur a grave risk of wasted effort. It is true, of course, that our conception of things is very liable to be upset entirely by quite trivial occurrences and revelations, but does Mr. Taylour appreciate the reason why modern progress is so very fast? Simply because each succeeding development has the advantage of utilising a relatively larger accumulated store of knowledge. The material question is whether this store is becoming greater than one individual mind can assimilate? An affirmative answer might be construed from the present tendency to specialise, but it is to be hoped that specialisation will not become so thorough that some change in environment will condemn man to the fate of the highly-specialised prehistoric animals which found it impossible to survive variation of conditions suited to their particular existence.

The Buenos Aires Exhibition

MOST optimistic views are entertained with regard to the results of the British Empire Trade Exhibition which ended on Monday last. Nearly 1,500,000 people visited the display and it is reported that the orders actually placed exceeded all expectations. But the success of exhibitions of this nature is not to be judged solely by the actual business done. They have far-reaching effects which cannot always be directly traced back to them, and in the case of such an ambitious display in a foreign country the "propaganda" value is inestimable; the regard which Argentina has for Great Britain has been considerably strengthened and the anticipation of more business from South America is not a vain hope. In this issue we print further views of electrical stands, &c., at the Exhibition, as well as a group photograph taken at a luncheon given by Messrs. Watlington and Siddeley to local members of the Institution of Electrical Engineers.

Aylesbury's Progress

DEVELOPMENT in rural areas is admittedly the most difficult work which a supply undertaking can embark upon. Consequently those who forge ahead in the country districts and succeed in bringing farmers and cottagers on to their lines are deserving of special credit. Aylesbury Corporation is one of these pioneers who are showing that if attention is given to educational work among rural communities such schemes can be made to pay within a comparatively short time. Under a scheme drawn up in 1926 by the engineer, Mr. W. A. Turnbull, electricity has been made available throughout an area of about 230 sq. miles. The latest move in the educational direction is the opening of excellent new showrooms—a matter with which we deal on another page. The premises are appropriately situated to attract the attention of farmers coming in from the surrounding country, for they are close by the Cattle Market. A representative selection of agricultural equipment is to be seen at the showrooms, and the domestic side of electricity is admirably demonstrated. We have no doubt that the Corporation's enterprise will be amply rewarded.

Metropolitan-Vickers and Russia

IT was announced this week that the Metropolitan-Vickers Electrical Co., Ltd., had concluded an agreement with the Soviet Government by which it undertakes to provide expert technical assistance in the manufacture of steam turbo-generators and other heavy electrical plant which is to be produced under the Five-Year Plan by the All-Union Electro-Technical Combine. This is the second agreement of the kind arranged between the two parties; the first is said to have been in satisfactory operation for four years. Although it is not made clear what benefits accrue to the Metropolitan-Vickers Co. from the agreements, it may safely be assumed that mutual benefits arise from them, and it is comforting to see that German, Swedish and American electrical manufacturers are not securing all the business that Russia offers.

The Weir Report

A Critical Examination of the Report of the Committee on Main Line Railway Electrification

By SIR PHILIP DAWSON, M.P., M.Inst.C.E., &c.

THE Weir Report on main line electrification has been published. It justifies the confidence that is placed in Lord Weir that this great problem has received thorough and unbiased examination and that the conclusions arrived at are complete and far-reaching. It confirms the statements which have been made by all those who have personal experience of the results of main line electrification and it should silence, once and for all, those " well-known authorities on railways " who decry electrification in the newspapers but whose names are never published, one of whom has recently stated that " for long-distance haulage it could easily be proved that steam is more efficient and economic than electricity." The Weir Report definitely states that " it can be said with confidence that electric traction has shown itself to possess definite elements of superiority over steam traction and that the system is being extended wherever it has been adopted."

The Terms of Reference

Unfortunately owing to the terms of reference it was to be feared that the results of the labours of Lord Weir and his colleagues would not be as fruitful as those of his Committee on the supply of electricity, which was the primary cause of the 1926 Electricity Act which was founded on, and very largely embodied, the recommendations and suggestions of that Report.

The terms of reference in the present case were, " to examine the economic and other aspects of electrification of the railway systems in Great Britain," although later an official statement was made to the Committee that the investigation " was not to stand in the way of, or affect the adoption of, any proposed schemes of further suburban electrification."

The Committee was not asked to make any recommendations or to submit any proposals as to how their recommendations were to be carried out. The decision on these points is left to the railways, the Government, and the country, the Committee only deals with " the essential economic factors which are clearly set forth in the Report." How far the Report will result in any definite progress in the near future remains to be seen.

Return on Capital Expenditure

The Report tells us that to electrify our main-line railway system will involve an expenditure of £260,000,000, and that the return on this, based on very conservative estimates, should be in the order of 7 per cent.; it further states that the electrification of our suburban system would require an additional expenditure of £45,000,000, which would show a return of 13 per cent. (an undoubtedly most conservative estimate). The report also quite rightly recommends that the Central Electricity Board should supply the whole of the electricity required by the railways directly to them in the form of d.c. current, and that this would mean an expenditure on the part of the Board of £80,000,000 (the interest on which would be included in the price at which electricity is supplied to the railways) and that the amount annually consumed by the railways would be in the order of 6,000 million kWh.

If the electrification of our railways was carried out merely with the object of securing a return of 7 per cent. on the capital expended, it is doubtful if it could be favourably considered, although, having regard to results achieved in other countries, the interest on the capital expended should reach 12 per cent.

In view, however, of our present industrial position would it not be more advantageous to face this expenditure, which would bring work to our heavy industries, which are in such dire distress, rather than to expend a similar amount, as has been proposed in Parliament, to build roads, houses, and to drain land, work which could but very slightly affect our heavy industries and an expenditure which would not be directly remunerative, in contrast to what would be the case if the main-line railways of the country were to be electrified?

The Report points out that considering the vast annual expenditure on roads which promote increased road haulage, which is in direct competition with the railways, and which cannot be directly remunerative, the mere magnitude of the sum involved in electrification should be no deterrent to the most earnest consideration of the electrification proposals, bearing in mind their economic and social merits.

All the advantages which have been constantly claimed for main line electrification, are fully confirmed by the Weir Report, as well as the benefit which, as it has so often been pointed out, would be conferred on the general public as the result of the Central Electricity Board being put in a far better position than it could ever be otherwise to provide, practically all over the country, " a cheap and abundant supply of electricity."

Indirect Advantages

The Report accentuates the fact that apart from any direct financial benefit which would result from electrification, there are many important indirect advantages associated with speed, comfort, amenity, improved services, and increased capacity, and that, in view of the competition of road transport and the existing industrial and agricultural depression, it is essential that our railways should examine new methods of reducing the cost of railway transportation.

Whether the railways will adopt this view is very doubtful. The Royal Commission on Transport pointed out that as regards road competition, the question arose as to whether the railways have been doing everything possible to meet it. In the days of their monopoly they paid scant attention to the needs of the public, compelling them to travel on lines at times and at speeds which were convenient to the railways, overlooking the established principle that " facilities create traffic." The Weir Report points out that electrification places in the hands of a traffic manager a new machine, which will enable him to offer a far more attractive transport proposition to his public and whose special characteristics are capable of extensive development.

Incidentally it is interesting to note that the Report does not consider that electrification would have an adverse effect on the number of people employed by the railways, and that the traction staff under electrification would operate under far more favourable conditions than under steam.

If there is any criticism on a report which confirms all the benefits which have ever been claimed for electrification, it is perhaps more due to the terms of reference than to any other cause, although some views are expressed on which general agreement does not exist.

Local Passenger Traffic

The Report does not seem to lay sufficient stress on the necessity of putting in hand immediately the electrification of those sections of our railways which handle local passenger traffic round our big towns, and in our densely populated industrial areas, although the Report rightly emphasises the well-established fact that as regards suburban traffic it is susceptible of substantial increase in volume and revenue under electric haulage.

The public is demanding better means of transport

to and from their work, and road transport is supplying this at present, although it could be accomplished far more satisfactorily by electrification. Instead of doing this the railways are opposing licences for coach services and expending large sums on acquiring road transport undertakings in an attempt to stifle competition. A fast and frequent electric service, for instance to Southend, would go a long way to deal with existing road competition.

Tenders for electrification for suburban services out of Kings Cross were considered twenty years ago and have frequently been considered since; now the Lord Privy Seal tells us that there is a scheme to electrify 55 miles of route out of Kings Cross, but he does not definitely state when this work is going to be taken in hand. This is playing with the problem, when we compare the proposals with the 276 miles of route now operated electrically by the Southern and with the 55 additional miles now in course of equipment. What about Liverpool Street, where the local services are practically what they were 30 years ago? Most of the trains to Epping have an average speed of only 13 miles an hour and a passenger may have to wait something like an hour for a train. Compare this with the service to Dartford, a train every few minutes at an average speed of about 30 miles an hour. About ten years ago a complete scheme for electrifying all the services out of Liverpool Street was prepared and but for "grouping" would have been in operation long since.

The Weir Report refers to the development of "air rights" over electrified stations, as has been done with such phenomenal success in the United States. This was proposed in the case of Liverpool Street and the value of the building site in that case would have gone a very long way to pay for the cost of electrification. Suburban electrification is the most urgent of all and no time should be lost in starting this work.

The Financial Aspect

If the railways were to find it difficult to raise the money, the Government with little or no risk to itself, could guarantee the interest on the capital required to carry out their electrification for a long period of years in the event of the additional net revenue earned by electrification not being able to meet this charge, so that the interest of existing shareholders would in no way be jeopardised.

If the railways agree to carry out the proposals outlined in the Weir Report, well and good, but it is quite possible that the Report will only serve as an excuse for the railways to continue their present attitude of "non possumus." There is no doubt that there are several main line sections of our railways where special conditions exist which would fully justify electrification at once.

This has been found the case on the Continent and the U.S.A. and in practically every instance such partial electrification has fully justified itself financially. Any partial or suburban electrification must, of course, be carried out on the basis that eventually all the lines would be electrified. If properly selected sections of main line are electrified, there should be no insuperable difficulty in so adjusting steam operations as to render the dual system economical, and this has been done in Europe and the U.S.A. In the case of any electrification being carried out it is of the first importance that the Central Electricity Board, as Lord Weir has suggested, should have additional powers granted to it so as to enable it to supply the railways direct, and that the railways should have the right to use the current so supplied for all and any purpose for which it is required by them.

Systems of Supply

The Report definitely advises the use of d.c. current in accordance with recommendations of the Board of Trade Railway Electrification Advisory Committee, and apparently 1,500 volts is the pressure it is proposed to adopt.

On this point it is interesting to note that the general opinions of the U.S.A. to-day, as well as in the case of the bulk of European main line electrification, is that the system which after many years of practical experience has been found to be the most advantageous is the a.c. one. The Pennsylvania Railroad, after years of experimentation with both systems, has definitely adopted a.c. for the electrification which is now being completed of all its lines between New York and Washington and New York and Harrisburg, the most important main line electrification ever carried out. Norway, Sweden, Germany, Switzerland and Austria have satisfied themselves that taking all factors into consideration, their decision to standardise a.c. has been more than justified. They consider it more flexible and it enables them to deal with branch lines economically, which in many cases would be impossible with d.c. It would be very interesting if a report on this subject could be obtained from the Pennsylvania Railroad. The current supplied from the Central Board at 50 periods would in any case have to be converted to d.c., and there is no insurmountable difficulty in converting it to a.c. as is done to-day in Sweden.

In conclusion, in this relation it is interesting to note that the eminent French engineer, Monsieur Parodi, who is responsible for the 1,500-volt d.c. electrification of the Orleans railway and the 3,000-volt d.c. Morocco railway, has stated that if he had to start *de novo* now he would be in favour of alternating current.

A New Radio Receiver

A 4-valve "Gecophone" Set for Direct-current Mains Operation

ALTHOUGH the larger proportion of the electricity supplied in this country is alternating, there are considerable areas wherein direct current only is available and wireless interests in such districts are apt to consider that they have been neglected to some extent by manufacturers of broadcast radio receiving sets designed for all-mains operation, particularly in the case of the more modern receivers, in which such factors as range, volume, and selectivity provisions have been developed to meet the demands of the times. It is, therefore, worthy of note that the General Electric Co., Ltd., among others, has laid itself out to provide what is needed in this direction by placing on the market a 4-valve set designed for all-mains operation and covering an input range from 200 to 250 volts. This receiver incorporates a circuit similar to that of the a.c. mains set which is capable of good performance for its type. It has been tried on a variety of d.c. mains (including a.c. rectified with mercury-arc rectifiers) to ensure that hum has been reduced to a negligible degree.

The set consists of two stages of radio-frequency amplification with screen-grid valves, a detector, and one stage of audio-frequency amplification in which a pentode is used. The valves are operated in series and two "Osram" S.215 type are used for the first stages, an H.210 for the detector, and a PT.625 for the output stage. The set, which is housed in an attractive walnut cabinet, complies fully with the I.E.E. and B.E.S.A. requirements. The whole of the electrical portion is insulated from the metal chassis and the ganged condenser, being of special construction, is so arranged that both the fixed and moving vanes are insulated from the case. The smoothing circuit is so designed that the set will function satisfactorily on mains of which either the positive or negative conductor is earthed without making any adjustment to the set. Furthermore, when the lid of the cabinet is raised the set is isolated from the mains by a safety switch, which is followed by a double-pole fuse that makes the set independent of the current rating of the distribution fuse. As a convenience for switching on and off a double-pole switch is fitted. The range of the set is from 230 to 550 metres and from 1,000 to 2,000 metres; while the power consumption is 56 watts at 200 volts. So far as the controls are concerned, at the left-hand end of the set are three knobs: one serving as the volume control, the second as the range switch, and the third one as the tuning control, which is adjustable to a precise degree. At the right-hand end of the set is a reaction controller and a mains switch. The front of the set is therefore clear of knobs or switch handles, only showing the wavelength indications through a neat escutcheon.

Other d.c. mains sets are the "Pye" and "R.I."

The New Vancouver Showrooms

To Capture New Business these Premises Present an Unusual Combination of Luxury and Utility

By F. H. FULLERTON

BELIEVED to surpass in many ways any other electrical store in the world, the new sales building of the British Columbia Electric Railway Co. at the junction of Dunsmuir and Granville Streets, Vancouver, B.C., stands as a monument to the inroads of the artistic into the sphere of practical merchandising. It is located in the heart of the shopping district and consists of four floors entirely devoted to the trading departments of the company, and provision has been made for the erection of seven additional storeys on the present foundations should the volume of business warrant this expansion. The exterior of the building is faced with Haddington Island stone, and the interior walls and ceilings are finished in tinted plaster. The windows are finished in Caen stone, and there is artificial cast stone used in the mantels above the fireplaces, all of which combines well with the plaster work.

Portion of Electric Fire Display Section in Vancouver Showrooms

Inside mahogany stands and glass cases abound, all displaying silver-plated percolators, toasters, and similar appliances, and on each side of the entrance are stands featuring percolators, urns and sets to match on trays.

A section of the main floor is fitted up as a drawing room. The floor is covered with heavily-piled rugs, and two fireplaces in huge artificial marble mantels give a comfortable glow of heat, although the store is amply provided for in the matter of heating equipment apart from this source. An elaborately constructed wrought-iron and polished-mahogany application and cashier's booth surround the rear portion of this floor, where all matters pertaining to light and power service are given attention, applications for new services are received, and payments of electricity supply accounts are made. The repair department also has a counter for receiving goods at this end of the store. The lighting of the main floor is worthy of particular attention. It is entirely of the indirect type, and the maximum intensity is approximately 40 foot-candles. There are six very elaborately-designed metal stands in the centre of the floor, each of which carries four 1,000-W lamps. The lighting from numerous table and floor standards, window lamps, spotlights, and showcases adds to the intensity mentioned. All the floor standards are equipped with colour screens and connected to dimming equipment. Each of the five side windows, which offer views right into the centre of the showroom, are equipped with two rows of " Holophane " reflectors, with 200-W lamps, and two 500-watt spotlights with colour screens. The window lighting is dimmer controlled. The two main windows, one on each side of the front entrance, have a maximum intensity of 600 foot-candles. The south window has three rows of Pittsburgh reflectors, making a total of 104 in all, each equipped with a 200-watt lamp, and three 500-W spotlights. The illumination of the north window is similar, except that the Pittsburgh reflectors are replaced by the " X-ray " type.

The lighting of the second floor has a maximum intensity of approximately 300 foot-candles from 500-W semi-indirect fittings. On this floor are located the two model kitchens, a special feature of which is the delightful rays of " sunlight " which penetrate through the windows from " D-lite " 150-W lamps located in front of the window glass, but out of the public view. A box of flowers on the ledge of the window on the outside adds a touch of realism to the effect. The kitchens themselves are fitted up to demonstrate the convenience of electrical appliances in the modern home. Lamp brackets are installed above the sinks and cookers, while correct kitchen lighting fixtures have also been installed. In one kitchen is fitted a refrigerator, a cooker finished in apple green to harmonise with the tiling of the walls, and a dishwasher with tiled-in effect over the sink. Hot water is provided by a 30-gallon tank fitted with a 2,000-W heater with thermostat control and a 750-W heater manually controlled. To-

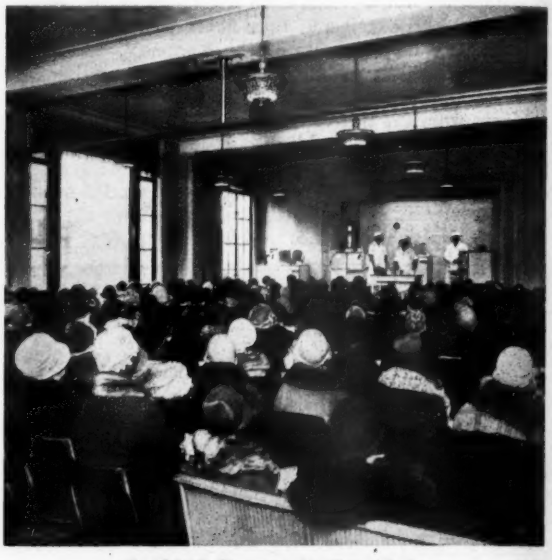
New B.C. Electric Store

wards the rear of the second floor is an auditorium for conducting small cooking schools. On the stage there is every facility for connecting up cookers for demonstrations. The stage is illuminated by two rows of twelve 150-W lamps, half with " X-ray " and half with Pittsburgh reflectors. A row of footlights is also installed. The stage lighting is dimmer controlled.

The centre portion of the second floor is "Toyland," where electric trains and street cars run up and down their rails all day long. Electric ovens provide a never-failing attraction for the little girls, while boys find a source of pleasure in electric motors, which may be used with engineering construction sets. The front portion of this floor is devoted to the display of cookers and refrigerators.

The third, and at present the top floor is devoted to radio, lighting, cleaning, sewing, and washing and drying equipment, and demonstrations are given continuously on each class of apparatus. A feature of the radio section is the two large mahogany-panelled demonstration rooms, furnished in a most delightful manner. Leaded glass windows are arranged around the walls at the top, while illumination is provided by six bracket lamps on the walls and a five-cluster fixture in the centre.

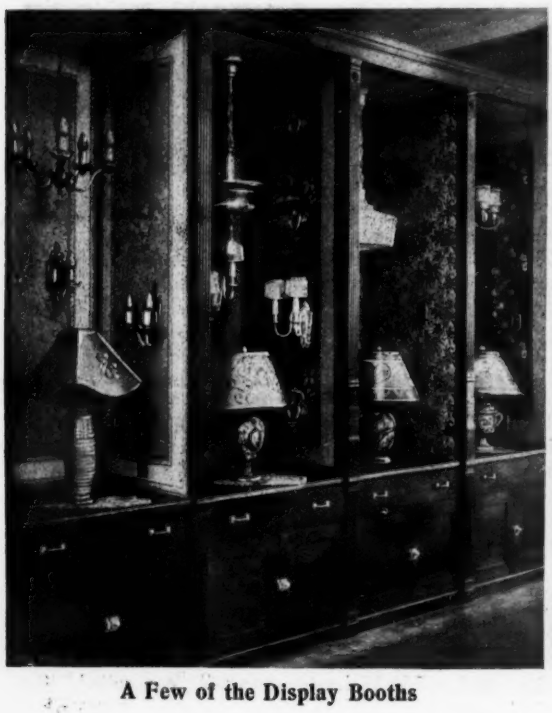
Several convenience outlets and ground plugs, both in the one plate, have been installed at close intervals around the bottom of the walls of the rooms to provide for plugging-in of demonstrating sets. On the roof for aerial purposes are two 40-ft. steel towers. The lighting on the third floor is composed of 46 enclosed 18-in. fittings with 500-W lamps, giving an intensity of from 30 to 40 foot-candles. There is a group of 48 lighting-fixture display booths on this floor, six of which are devoted to direct and indirect equipment, four to porch-lighting fittings, and the remainder to domestic-lighting apparatus. These boxes are approximately 3 ft. wide and 7 ft. in height, and are raised about 3 ft. 6 in. above the floor level. The



Cooking Demonstration Room

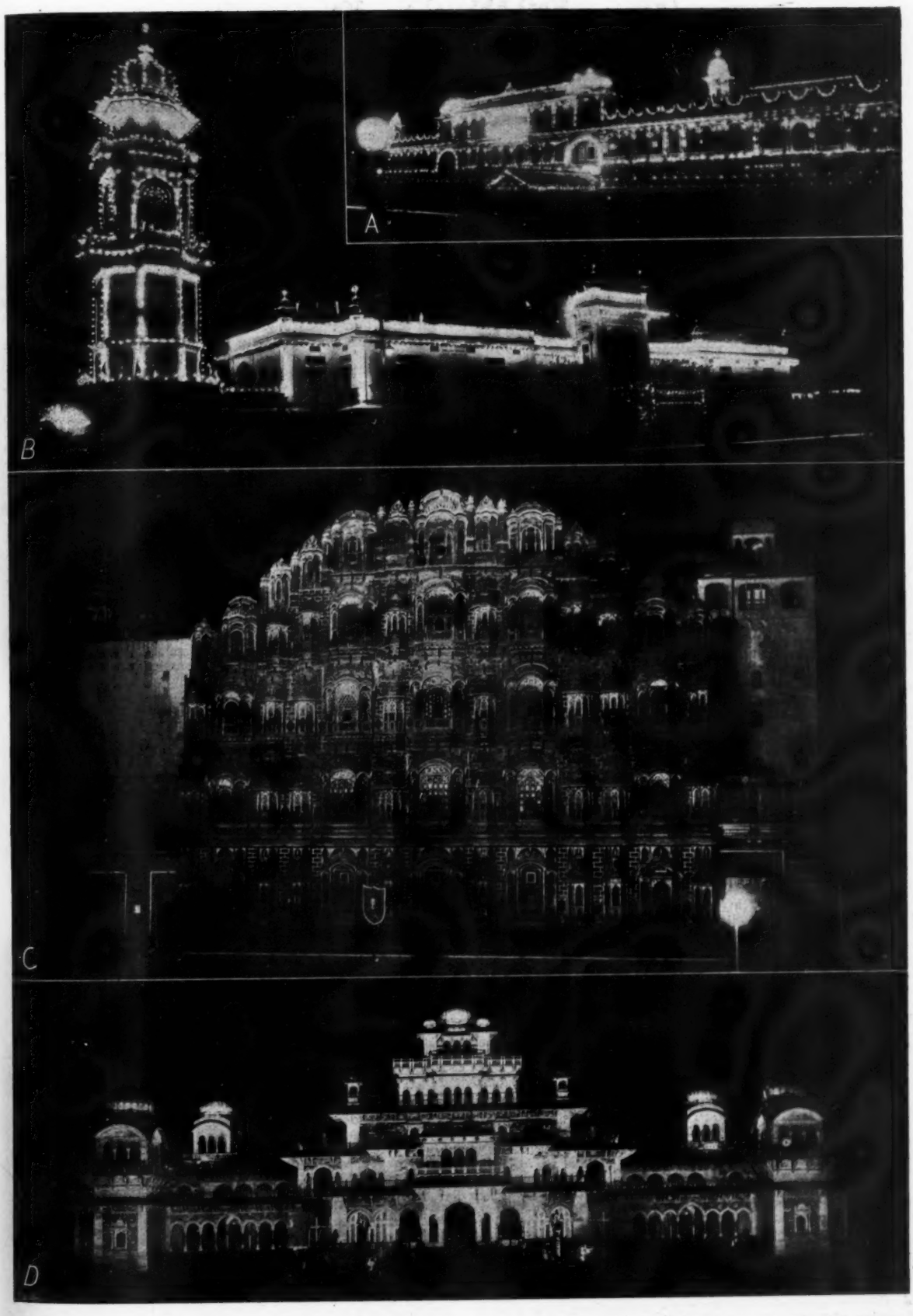
decorations and furniture in each booth afford the appearance of a small room. Suitable outlets of every description are provided. In the centre of the floor immediately in front of the booths a massed display of stand lamps and table lamps is arranged in a most tasteful manner.

As in the window lighting of the store, colour predominates in the floodlighting of the exterior of the building. Twenty-three 1,000-W projectors are mounted on the canopy above the entrance to the store, all connected to a flasher operating 3-colour combinations.



A Few of the Display Booths

A Window Lamp Exhibit



On March 14th last H.H. the Maharaja of Jaipur, India, was invested with full ruling powers by His Excellency the (then) Viceroy of India (Lord Irwin). Lord and Lady Irwin arrived at Jaipur City on the morning of March 13th and left again at 11 p.m. the following day. Both those days were holidays and at night the city was electrically illuminated. Some idea of the extent and magnificence of the illuminations may be gathered from the above illustrations. A, part of Tripolia Bazar, one of the main thoroughfares; B, King Edward Memorial; C, the Hawa-Mahal, or Palace of Winds, floodlighted; D, Albert Hall Ram-Niwas Garden—a museum—floodlighted. In illustration C one of the street lamps is shown; the street lighting in the city is arranged on the constant-current, series h.p. system at 3,300 V, 6.6 A. We are indebted to Mr. H. Fawcett, electrical and mechanical engineer, Jaipur State, for the illustrations.

The Railway Report

A Reasoned Statement of the Essential Factors of Main Line Electrification

LAST week we devoted some space to discussing the main features of the Report of the Committee on Main Line Railway Electrification and their implications. The Report itself has now been published (H.M. Stationery Office, 3s. net), and we give below further particulars.

The British railways (excluding the Tubes and Metropolitan) have an issued capital of £1,154,770,000, and employ 646,000 persons; they use 23,400 steam locomotives running 594 million miles per annum over 20,300 route miles (52,500 track miles and sidings); they transport some 1,348 million passengers and 330 million tons of goods and minerals. The Committee considers that no developments yet manifest are likey to displace the railways from their position as our main transport agency.

As no general scheme of main line electrification is possible without the inclusion of non-electrified suburban lines, the expression "main line" in the terms of reference has been regarded as including all non-electric railways.

Present State of Electrification

The 18 route miles of mineral section on the L. & N.E.R. is the only electrified main line in Great Britain, but 487 route miles of suburban lines (Tubes excluded) are electrified as follows:—

Southern Railway ...	276	L.M.S.R. (Lancashire	
Metropolitan Railway ...	31	areas)	60
Metropolitan District		L. & N.E. (Tyneside area)	32
Railway	25	Mersey Railway	5
G.W.R. (London area) ...	7	Liverpool Overhead Rail-	
L.M.S.R. (London area)	45	way	6

In addition there are under construction, or approved, schemes for the following additional mileages:—Southern Railway, Purley-Brighton and Worthing, 51; L.M.S. and L.N.E. Joint, Manchester-Altrincham, 9; L.M.S. Barking-Upminster, 8. The S.R. extension to Brighton and Worthing might almost be regarded as a main line scheme, but the traffic is of a suburban nature and therefore the additional facilities are likely to induce additional traffic.

The following table gives the approximate route mileages electrified, both suburban and main line, in various countries:

Australia	256	Japan	215
Austria	443	Mexico	79
Canada	40	Morocco	150
China	25	New Zealand	15
Cuba	156	Norway	143
Czecho-Slovakia ...	30	South Africa	194
France	1,048	South America ...	544
Germany	968	Spain	370
Holland	84	Sweden	726
India	151	Switzerland	1,542
Italy	1,013	United States	1,870

The outstanding example in Europe is the Swiss Federal Railway, where some 1,100 route miles (66 per cent. of the total), carrying 85 per cent. of the traffic, are operated electrically. Abroad the situation has been influenced largely by the existence of water power, severe gradients, or long tunnels, but the Committee is satisfied that, at present prices of coal and in conjunction with the grid, it is possible to supply electricity at a cost comparing favourably with that produced by hydro-electric stations.

The economic success that has attended suburban electrification is due to its ability to cope with dense passenger traffic causing heavy peaks, coupled with absence of smoke, while the better service has increased the off-peak traffic.

Railway Supplies from the Grid

A pronouncement by the Central Electricity Board on the reactions of a railway load on national electrical development is quoted. The average cost of production will be reduced more rapidly than would be possible without railway electrification, and the diversity between the demands of traction and of authorised undertakers will also have a favourable reflection in the cost of generation for both parties. It is emphasised that general expansion—particularly industrial expansion—of the use of electricity is aided by every lowering of cost, while the possibility of tapping secondary lines to railway sub-stations will enable supplies to be given commercially in many sparsely populated areas. The C.E.B. has quoted 0.5d. per kWh delivered at the d.c. bus-bars of the traction sub-stations based on a load factor of 50 per cent., the railway companies operating the sub-stations. For a consumption of 6,000 million kWh (sub-station output) for complete electrification in 20 years' time the price is estimated at 0.475d. per kWh.

At present the C.E.B. may supply railways in the areas of authorised undertakings only indirectly, but it would be obviously impracticable for the C.E.B. to make individual agreements with the many supply undertakings concerned. It is therefore concluded that the Board should have powers granted it to supply railways direct for use for any purpose at any point on their systems.

Oil Engines and other Alternatives

The essential characteristic of electrification is the removal of the generation of power from the train. Investigations of the use of oil-electric sets has shown that for a line with a frequent service it would be more economical to install them in fixed generating stations, supplying current to moving trains, rather than on the trains themselves. Moreover, apart from the lower cost of energy available from the coal-fired grid stations, it is preferable on national grounds that home-produced coal should be used. Oil-electric units may be possible substitutes for steam on lightly loaded branch lines. The fuel economy of the steam locomotive is likely to be improved, but this will probably be offset very largely by additional maintenance costs and higher capital charges. No available evidence indicated the feasibility of battery locomotives, even for light units.

In addition to the financial advantages of electrification shown later, the increased acceleration and average speed allow for important advantages, including speeding up (though not necessarily any increase in the maximum speed). The expenditure on electrification is mainly represented by apparatus already of very high efficiency and capable of no outstanding improvement; obsolescence is therefore small, thus differing from steam and oil engines. The obsolescence charges on power station plant, which is liable to steady improvement in efficiency, would not affect the railways.

Economies with Electric Haulage

In 1929 the components of haulage costs affected by electrification (pence per engine mile) were: locomotive and shed wages, 9.0; locomotive repairs and renewals, 5.6; fuel, 5.3; guards' wages, 1.8; oil, cleaning and miscellaneous, 1.8; total 23.5. Locomotive and shed wages will be reduced because with electric tractors no time is lost in raising steam, coaling and watering, movements to turntables, &c.; daily cleaning and maintenance will be reduced apart from the fact that 30 per cent. fewer tractors will be required (owing to the much larger annual mileage obtainable from the the electric units). With multiple-unit stock only one motor-man would be employed instead of the two needed with steam. The elimination of the boiler and reciprocating parts has an important bearing on maintenance costs, and experience has proved that the frequency and extent of periodical overhauls are far less with electric locomotives than with steam.

Two Detailed Investigations

Arrangements were made with Messrs. Merz and McLellan to investigate two sections of railways. One, the L. & N.E. (briefly, King's Cross to Leeds and to Grimsby), is fairly typical of British railways; the other, the L.M. & S. (briefly Crewe to Carlisle and Crewe to Liverpool) includes certain factors usually favourable to electrical working, such as dense traffic and heavy gradients. In the first case it was to be assumed that all other lines were also electrified (*i.e.*, no dual working); in the second only the section chosen was to be regarded as electrified. The lengthy and detailed technical reports of the consultants are given in appendices, but their main features may be summarised as follows:—

	L.N.E.	L.M.S.
Total route mileage	492	198
Total track mileage	1,944	843
Trailing ton miles per annum electric	6,000,000,000	2,225,000,000
Trailing ton miles per annum steam hauled ...	—	395,000,000
Engine miles (electric)	21,000,000	7,950,000
Engine miles (steam)	—	1,590,000
Traffic density, trailing ton miles per running track mile per annum	4,300,000	4,050,000
(Estimated comparable average density for whole country	3,000,000.)	
	£	£
Net capital outlay	8,646,000	5,123,000
Savings in working expenses	624,600	127,800
Percentage return on net capital	7.22	2.5

The price of copper (wire bars) has been taken at £70 per ton (in January of this year it was £47 10s.), and coal has been taken at existing prices. A rise or fall of 1s. per ton in the prices of coal would increase or decrease the percentage return in the case of the L. & N.E. investigation by 0.225.

The investigations showed that the heavy first cost of overhead equipment and of electric tractors is only justifiable when adequate use is made of them. The tractors were worked only to half of their capacity of about 80,000 miles per annum, due to the small size of the scheme and to dual working.

Independent General Estimates

Two general estimates of the cost of electrification of the whole of the British railways were submitted by Mr. J. M. Kennedy and by Mr. H. W. Richards (of the L. & N.E.R.). In both cases the final results indicated a return on capital spent on electrification slightly higher than the 7.22 per cent. calculated on the L. & N.E. scheme. It was decided, in order that the estimates might be on a conservative basis, not to include as definite financial credits a number of items, the saving due to which could not be readily assessed. The estimates given in Tables I and II may be regarded as being as sound and authoritative as any overall estimates can be without a detailed survey.

TABLE I.—ESTIMATED CAPITAL COST OF ELECTRIFICATION OF ALL STANDARD-GAUGE STEAM-OPERATED RAILWAYS IN GREAT BRITAIN.

	£ millions	Credit items	£ millions
Track equipment	129.7	Steam tractors	45.5
Auxiliary power cable ...	13.5	Coal stocks	1.38
Alterations to way and works	13.7	Spare parts	4.5
Electric tractors	136.5	Locomotive coal wagons ...	2.4
Running sheds, shops, stores, &c.	4.5	Passenger coaches	2.5
		Surplus plant, &c.	4.0
Spare parts	5.5	Train lighting sets	2.0
Auxiliary power supplies ...	2.25		
Interest during construction ...	12.5		
Engineering expenses	5.0		
Total gross cost ...	323.15	Total credits...	62.28
Net capital cost			... £260.87 (say £261,000,000)

The additional expenditure on generating plant, transmission lines, and sub-stations, to be incurred by the Central Electricity Board and other authorised undertakers, would be approximately £80 millions. The economic return on this sum is included in the price to be paid for electrical energy.

TABLE II.—ESTIMATE OF COMPARATIVE WORKING COSTS
(Including only items affected by electrification.)

	Steam	Electric	Saving
	£	£	£
Locomotive fuel or electrical energy	12,310,446	11,280,000	1,030,446
Locomotive wages	20,933,425	10,778,712	10,154,713
Repairs of tractors	10,819,012	4,660,000	6,159,012
Water for locomotives	883,666	—	883,666
Stores, clothing and miscellaneous	905,992	453,000	452,992
Lubrication	290,415	102,000	188,415
Maintenance of engine sheds and shops ...	436,959	175,000	261,959
Guards' wages	4,296,462	3,653,462	643,000
Cleansing of vehicles	933,500	700,100	233,400
Insurance, pensions, &c.	794,250	397,150	397,100
Savings on maintenance of train lighting sets	—	—	513,000
Savings on auxiliary power and light supplies	—	—	840,000
Totals	£52,604,127	32,199,424	21,757,703
Additional costs of electrification :—			
Maintenance and renewals of electric track equipment		3,385,000	
Maintenance and operation of sub-stations ...		1,056,000	
Increase in depreciation (renewals) of electric tractors compared with steam		20,000	
Total		£4,461,000	
Gross savings due to electrification	21,757,703		
Deduct extra costs of electrification	4,461,000		
Net saving due to electrification	17,296,703		
Additional net revenue on haulage of coal to power stations	254,000		
	£17,550,703	6.7 per cent. on £261,000,000	

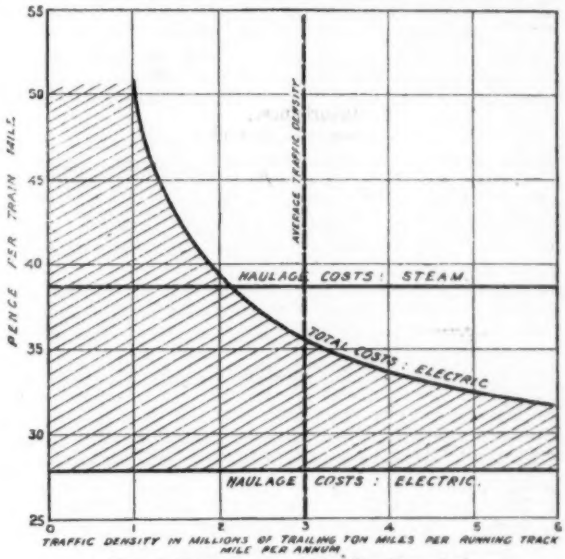
Assuming electrification on a 20 years' programme, under existing traffic conditions, there would be a surplus of approximately two per cent. after meeting interest charges on new capital, a margin which the Committee considers too narrow for the risks involved, if it were not for the great importance of elements which do not lend themselves to direct monetary assessment. Among these are speedier and more satisfactory service, particularly in view of competition of rival forms of transport. It is shown in the diagram above how the savings as compared with steam may be expected to improve when, either through better service or the general development of industry, the volume of traffic is increased.

The Suburban Lines

The estimate of £45 millions as the additional expenditure on a general intensification of suburban electrification (yielding a return of 13 per cent.) is based entirely on the assumption that it is imposed on a scheme of general electrification. A suggestion that all suburban sections should be electrified first, with a subsequent linking up by electrified main lines, is received with caution, as probably in many cases the handicap of dual working would affect the financial return arising out of increased suburban traffic.

Effect on Operating Staff and on Coal Industry

Although a reduction of about £10 millions in locomotive wage costs is the chief saving under electrification, it is held that, over a period of 20 years, there will be no serious adverse effects on the grades concerned, particularly in view of the intensification of suburban services. Moreover, the



Fixed Charges and Traffic Density

working conditions will be substantially more favourable than at present. Steam locomotives in 1929 consumed 13,400,000 tons of coal, or 5.2 per cent. of the total tonnage raised. Under electrification, the consumption in 1950, at 1.43 lb. per kWh sent out from sub-stations, would be 3,650,000 tons, so that the net annual reduction would be about 3.8 per cent. of the national output.

The Manufacturing Aspect

British manufacturers would be prepared to pool their resources and could generally supply all equipment with existing facilities if the work were spread over a period of 15 years. With the exception of the imported raw material, mainly copper, substantially all the capital sums would be distributed in this country ultimately in the form of wages. Some 60,000 workers would have continuous employment, and the savings in cost due to steady output are expected to be from 10 to 15 per cent. (no account has been taken of such savings in the estimates of capital expenditure). A very considerable portion of the expenditure would go to the iron and steel, structural, and building industries. Any programme of this nature would greatly increase the power of British electrical manufacturers to compete in the world's market due to the steady nucleus of work over which to spread their standing charges. The mere magnitude of the sum involved in the complete electrification of our railways should be no deterrent in itself to the most careful and earnest consideration of such a programme on its economic and social merits.

The Faraday Commemoration at Battersea

SAINT George's Day was fittingly selected for the first public celebration of Faraday's most important discoveries when a memorial stone at the site of the new Battersea power station was unveiled by Mr. W. F. Fladgate, M.V.O., J.P., chairman of the London Power Company, at the formal request of the Rt. Hon. the Earl of Bessborough, G.C.M.G., who spoke from Ottawa, some 3,000 miles away.

Lord Bessborough said that Canada was at one with Great Britain is desiring to honour that great Englishman, Faraday. Electricity had meant more in the development of Canada than could be measured.

The inscription on the stone reads: "On St. George's Day, in the year of the centenary of Michael Faraday's great discovery, this stone of commemoration—unveiled at a moment about noon and by a wireless message by His Excellency the Governor-General of Canada, the Right Honourable the Earl of Bessborough, G.C.M.G., a former director of the company—was placed as a landmark in the development of larger London's light and power, and to serve as another memorial of the scientific heritage derived from famous Englishmen. Battersea Power Station, April 23rd, 1931."

The ceremony was followed by a luncheon at which about 200 people were present; the whole of the cooking was done electrically, Siemens's "Xcel" equipment being used.

The Rt. Hon. Herbert Morrison proposed "The British Electrical Industry." He said that before the controversy regarding the possible emission of smoke and grit and sulphur fumes had become a big issue, the Electricity Commissioners had required that the company should take the best known precautions for obviating nuisance. He was anxious that all the industries with which he was associated as Minister of Transport should be conducted not only economically but also to promote amenity. The substitution of electricity for smoke-producing factory chimneys would be a great advance towards minimising fog trouble. The London Power Company (representing the West-End group of ten companies) now owned 535,000 kW of plant in five existing stations and its output in the year ended March 31st, 1930, was 784 million kWh, or 20 per cent. of the total output for the S.E. England area. The various electrical trades were mutually dependent, and unprogressive policies in any one section were injurious to the others.

Mr. W. F. Fladgate responded, and also proposed the toast of "The Guests." He showed that the generating costs per kWh (including capital charges) of the company had fallen from 0.882d. in 1926 to 0.588d. in 1930. This 50 per cent. improvement was equivalent to £2,900,000, which had been passed on to the consumers, since the company could pay only a fixed dividend.

The Dean of York briefly replied on behalf of the guests.

As April 23rd is also Mr. Fladgate's birthday, the opportunity was taken by Mr. H. R. Beeton, director of the Brompton and Kensington Co., to present him with a silver salver from the directors and senior officers of the group of companies. Mrs. Fladgate at the same time was presented with a bouquet.

Transformer Protection

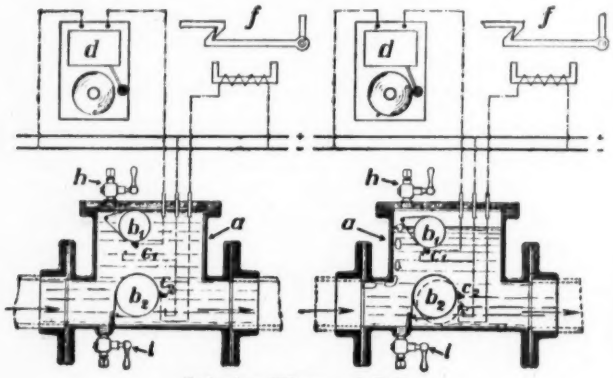
How the Buchholz Relay Works

By D. A. BOWER

THE ideal protective system must perform the following functions, infallibly :—(1) Give warning of the first symptoms of unhealthy conditions of the insulation and oil. (2) Isolate the transformer from the system only if the disturbance (either external or internal) be of such a nature that further use will cause serious damage. (3) Indicate the cause of the disturbance.

As a necessary complement to such a system, careful and regular inspection of the transformer and its oil is essential, as well as the use of current-limiting, surge-arresting, and coil-bracing devices, in addition to re-inforcement of the insulation of end turns. Whenever physical or chemical changes take place in an oil-cooled transformer, gas or vapour is produced. The properties of the gases and the rate of liberation are dependent on the nature and extent of the chemical and physical phenomena, and of the disturbance which causes it.

The majority of transformer failures are due to short circuits between adjacent turns of a coil caused through electromagnetic shocks, excessive mechanical pressure, chafing due to vibration, the presence of moisture, and pressure surges. The local heating which precedes a fault of this kind decomposes the adjacent oil and generates small bubbles of gas, which rise to the surface. Gas is also evolved due to the disintegration of the insulation. As a result of the breakage of a conductor an arc is formed, which tends to lengthen rapidly due to the fusion of the metal, thus volatilising the oil. Faults of this kind frequently manifest themselves by the escape of oil fumes from the tank. In the case of a fault to earth, the resulting arc causes gas to be generated in the oil.



Interior Views of Relay

An external short circuit or a severe overload causes the temperature, particularly in the internal layers of the windings, to rise rapidly. The oil enclosed by the coils is quickly volatilised, and the resulting gases are violently expelled to the exterior of the windings in the form of small bubbles.

Sludging, in addition to being due to high oil temperature, is also accelerated by the presence of bare copper and air. The dielectric strength of transformer oil is seriously reduced by the presence of even the slightest traces of moisture, and also by modification in its chemical properties. As a result certain spots are subjected to excessive electrostatic stresses, and discharges are produced which decompose the oil with the resultant production of gas.

The most common causes of difficulty in the magnetic circuit are the failure of core-bolt insulation, of insulation between laminations, and badly constructed joints between cores and yokes. These conditions result in the production of intense eddy currents, and very high local temperature. The surrounding oil is consequently decomposed, and the evolution of gas results.

The Buchholz protective system depends for its operation upon the gases produced by disturbances which actuate a relay. The latter operates a warning signal and ultimately isolates the transformer.

The relay is connected between the oil conservator and the transformer itself. In the interior view of the relay shown herewith the receptacle (*a*), which is normally filled with oil, contains two ball floats b_1 and b_2 capable of movement on fixed axes.

Small bubbles of gas, produced as a result of a minor fault, rise inside the transformer tank and are trapped in the receptacle (*a*), resulting in a progressive reduction in the oil level, which causes the upper float b_1 to move downwards through a corresponding distance. When a predetermined quantity of gas has collected, float b_1 closes auxiliary contacts c_1, which complete the alarm circuit (*d*). If the evolution of gas continues, the oil level in the receptacle falls to such a point that the gas can reach the conservator.

A calibrated inspection glass in the receptacle enables the operator to observe the quantity and colour of the liberated gas. The quantity of gas produced in a given period is a measure of the importance of the fault and of its development. The colour of the gas is a very useful guide as to the location and nature of the trouble; white or colourless gases denote the disintegration of paper insulating materials; yellow gas indicates the deterioration of wood; and cloudy-black or grey gases are produced by decomposition of the oil.

The lower float b_2 remains in its normal position, so long as the gas is liberated slowly. If the fault intensifies, the liberation becomes more violent. Large bubbles are produced in the vicinity of the fault and oil is expelled very rapidly through the tube leading to the conservator. The high rate of flow causes the float b_2 to turn around its pivot, and it will then occupy the position shown by the dotted circle. The movement of float b_2 through a predetermined distance closes contacts c_2 which complete the auxiliary circuit (*f*) through the tripping coils of the circuit breakers on both the primary and secondary sides of the transformer.

If the transformer becomes dangerously overloaded, either due to excessive load current or to a short circuit on the secondary network, numerous small bubbles are formed in the immediate vicinity of the windings. These small bubbles combine rapidly to form larger bubbles, which cause the oil to be expelled abruptly, thus actuating the float b_2, so that the circuit breaker is tripped before any damage can be caused.

As the temperature at which transformer oil volatilises is in the region of 150 deg. C., the temperature of the interior of the windings must necessarily be only slightly above this figure when the gas bubbles are formed. Temperatures up to 160 deg. C. can be withstood for short periods by the windings of modern transformers without damage. The period during which this temperature is attained is dependent on the temperature of the windings at the commencement of the overload and the magnitude of the overload. The time characteristic of the Buchholz relay is governed by the conditions prevailing before the disturbance and also by the severity of the overload.

Short circuits, such as occur occasionally in overhead transmission systems, do not cause the relay to operate if their duration is not so long as to cause the temperature of the windings to exceed about 160 deg. C. If, at the time when the short circuit occurs, the windings are heavily loaded, *i.e.*, they are at a comparatively high temperature, the critical point may be reached as the result of short circuit or overload of very short duration. In all cases the maximum temperature is the factor by which the relay is influenced.

The mechanical design of the relay is such that float b_2, *i.e.*, the tripping float, is not actuated unless there is a *sudden* displacement of oil, due to the rapid liberation of gas. For this reason, convection currents and oil movement due to electrodynamic forces in the windings do not operate the relay.

If the oil level falls below a predetermined limit, due either to lack of supervision or to a fracture of the tank, the contacts c_1 will close, thus completing the alarm circuit. Further decrease of level results in the closing of contacts c_2, due to the lowering of float b_2. The transformer is consequently disconnected by the automatic tripping.

If there is continuous entrance of air due to a faulty oil circulating system, the damage is certain to cause costly trouble, as a transformer incorporating a separate oil cooling system is necessarily one of large capacity. The air becomes trapped in the receptacle and operates the floats in the same manner as for other faults.

The Buchholz relay is provided with a valve (*h*) at the top of the receptacle (*a*) to enable the accumulated gas to be drawn off. If a flame is applied when the valve is opened, it is possible to ascertain if the accumulated gas is air or the combustible products of oil decomposition. A testing valve (*i*) is also fitted to the bottom of the receptacle (*a*), so that the relay may be caused to function by the use of a testing pump. In this manner it is possible to check the operation of contacts, connections, floats, &c.

About 4,000,000 kVA of transformers are at present protected on this system. Acknowledgment is due to Messrs A.C.E.C. (Ateliers de Constructions Electriques de Charleroi) for the illustrations of the relay.

Slip-ring Maintenance

Troubles due to faulty design, etc., are discussed, and useful remedial hints are given

COMMUNICATED

THE function of a slip ring is to permit easy transference of electricity between the windings of a machine and the external circuit. Slip-ring design involves consideration of several important problems. Very frequently the rings are made of some form of bronze, the ordinary Admiralty gun-metal (Cu. 88 per cent., Sn. 10 per cent., Zn. 2 per cent.), and a phosphor-bronze (Cu. 89.6 per cent., Sn. 10 per cent., P.O. 4 per cent.) being typical examples. Ordinary cast-brass and cast-iron rings are quite common, whilst in the case of turbo-alternators and induction motors steel and malleable iron have been used. Steel and iron generally possess a number of inherent disadvantages compared with brass and bronze, albeit, of course, they are appreciably cheaper in the first instance. Their thermal conductivity is much lower, and consequently the heat generated over the area of contact is not so readily carried away. The contact drop is about one-third as much again as bronze when clean, and even higher than this when the rings rust or tarnish. Unfortunately this takes place very easily and fairly constant attention is necessary to prevent it. The question of heat treatment is one which has, as yet, barely been studied. It is quite possible that appreciable improvements may be obtained in this connection, but the general practice at present is for rings to be machined and mounted as cast.

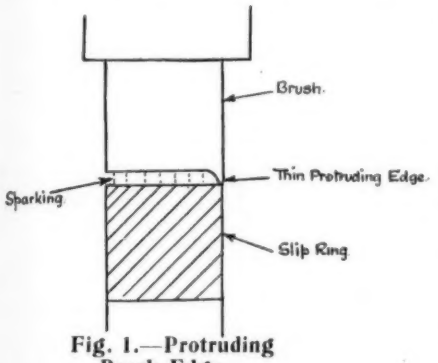


Fig. 1.—Protruding Brush Edge

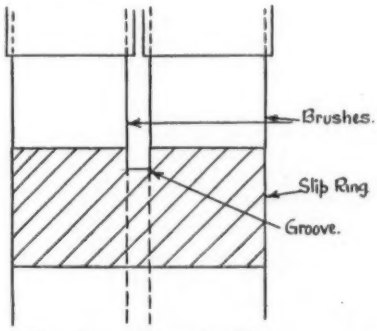


Fig. 2.—Groove in S.R. Between Brushes

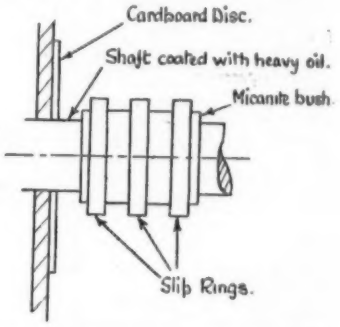


Fig. 3.—Protection of Windings During Trueing

Many of the troubles met with in operation may be traced, not to slip-ring design, *per se*, but to restriction in the number of brushes. It is good policy for a designer to err on the generous side, both in the number and the distribution of brushes. It is essential that the brush width be so restricted that a thin protruding edge cannot form; if an edge of this nature wears on a brush, extra axial oscillation of the rotor tends to lift the brush and so cause sparking (see fig. 1). Obviously, too, it will not be long before this edge breaks away Similarly, grooving of the commutator must likewise be avoided; where two brushes operate on each ring it is customary to groove the ring and so prevent ridges of metal being formed between the brushes (see fig. 2). Generally, a metal-graphite brush is preferred for slip-ring work. It has a lower contact drop than the pure-graphite type, and consequently gives a slightly higher machine efficiency. Further, heavy overloads are handled better by the metal-graphite brush. The current density may vary widely, and this, of course, will largely govern the choice of type; from 60 to 150 amperes per sq. in. represents approximate working limits.

Slip-ring troubles may be of three types as follows:—

Mechanical Abrasion.—The extent of this depends chiefly on the type of brush and the brush pressure. For given conditions there should be very little variation, always provided the slip rings are kept in good condition.

Arc Effect.—This is the name given to the phenomena of the transfer of metal from ring to brush in the direction of the flow of current. As a result the wear on the rings tends to become uneven, particularly with a high current density; this wear may be appreciably retarded by reversing the exciter leads occasionally. Some indication of the extent of this action may be obtained by careful examination of the rings. The negative ring retains a bright surface, metal being deposited on the brush contact face whilst the positive ring tends to become discoloured, due to carbon being deposited from the brush.

Burning Action.—So long as the rings are kept in good condition there will be little wear due to burning. It is when a flat has once been formed, frequently due to the arc effect discussed above, that the burning action becomes accentuated. The brush will not accommodate itself to the uneven ring surface passing its contact face, and each time the flat area comes round, due to this imperfect contact, sparking and burning take place.

Cleanliness is a *sine qua non* in the electrical world, and the slip rings and brush holders should have a weekly inspection and clean, particular care being taken to remove any dust which may have collected and which is a potential cause of trouble. The importance of the surface of the rings has already been stressed; if brush troubles are to be avoided a really good surface must be maintained, and this can best be obtained by using a sandpaper block and a stone. If the rings have got into very bad condition it may be advisable to carry out a preliminary trueing operation with a diamond-pointed lathe tool. During this operation every effort should be made to prevent metallic particles being drawn into the windings. This can easily happen as the result of the residual magnetism of the machine, and it is a fairly simple matter for such particles to work themselves into the insulation and in due course cause an earth, which may prove an expensive matter to remedy. One method of avoiding this trouble is to block the opening to the interior by means of a disk of stiff cardboard, the shaft being well coated with a heavy grease (see fig. 3). The grinding should be carried out with a stone 6 in. or 8 in. in diameter, the two surfaces at the point of contact moving in opposite directions. It is, of course, essential that the insulation resistance be checked before the machine is put back into service, both between rings and from each ring to earth.

In the case of metal-graphite brushes good ring surface is of the greatest importance. These brushes, due to their composition, possess a higher degree of inertia and so are unable to adapt themselves to variations of ring surface. A rough surface, or a flat, causes sparking and increases the losses; this in turn accentuates the rough surface, and so the trouble builds up. Brush tension should be periodically tested to see that the brushgear is functioning correctly and that it is not fouled with dust and dirt; usually a pressure of about 2 lb. per sq. in. of contact surface is used.

Rheostatic Tram-car Braking

A simple method by which the voltage and current on any given controller notch may be found for any given speed.

Within a limited range the relationship between flux and current in a series motor may be represented by $A/\Phi - B/I = 1$ .....(i); where A and B are constants, Φ = flux in Kapp lines, and I = current in A; *i.e.*, $I/\Phi = (B+1)/AI$.....(ii).

If the voltage generated during braking = E, then $E = 2\Phi NZ \times 10^{-8}$, where N = r.p.m. = K × m.p.h. or km./hr., and Z = total number of conductors on the wave-wound armature.

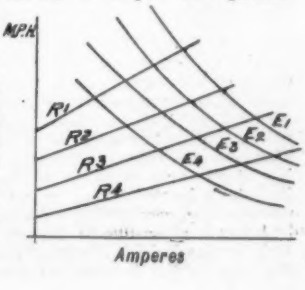
$\therefore E = 2\Phi(K \times m.p.h.)Z \times 10^{-8}$.....(iii), or $m.p.h./I = E/I \times (10^8/2KZ\Phi)$.....(iv).

E/I = total equivalent resistance of the circuit = R.....(v).

Substituting (ii) and (v) in (iv), $m.p.h./I = R(B+1)10^8/2KZA$, or $m.p.h. = R(B+1)10^8/2KZA$.....(vi).

If m.p.h. are plotted against current for any given resistance a straight line results.

If, therefore, a series of curves of m.p.h. are plotted against current for chosen generated e.m.f.'s and a series of straight lines are calculated from (vi) for different notches, *i.e.*, with different resistances in the circuit, and superimposed on these curves, it is possible to read off the values of the voltage and current produced for any particular notch and speed. This is shown in the accompanying curves.—H. R. BROADBENT.



The September Celebrations

A series of autumn functions will commence with the International Illumination Congress, be followed by the Faraday Centenary celebrations and exhibition, the Institution of Electrical Engineers yearly "summer" meeting, and terminate with the annual gathering of the British Association for the Advancement of Science

AN ambitious scheme of spectacular exterior illumination and the floodlighting of prominent public buildings is being organised as part of the programme of events for which delegates from many countries will assemble in London in September next.

Illumination Congress

The month's activities are to commence with the International Illumination Congress, 1931, which is being held in England for the first time, it having assembled previously four times in Switzerland and once each in Germany, France, Italy, and the U.S.A. Organised by the National Illumination Committee of Great Britain in co-operation with the Illuminating Engineering Society, it is to be held under the auspices of the International Commission on Illumination in two parts: namely, sight-seeing and visits to places of technical interest in London, Glasgow, Edinburgh, Sheffield, Birmingham (September 2nd to 13th), and then at Cambridge, where the various technical meetings and the plenary session of the I.C.I. will be held in Trinity College (September 14th to 19th), the 13 National Committees having been asked to secure papers on 15 subjects. The president is Mr. Clifford C. Paterson, the chairman of the General Council Lt.-Col. K. Edgcumbe, and the hon. treasurer Sir Francis W. Goodenough.

Faraday Centenary and I.E.E. Visits

In commemoration of the electromagnetic induction discoveries of Michael Faraday in August and September, 1831, a week's appropriate celebrations have been arranged to take place as follows:—

Royal Institution.—Monday, September 21st—evening commemorative meeting at the Queen's Hall.

Institution of Electrical Engineers.—Tuesday, September 22nd—morning conference at the Kingsway Hall and discourses on the place of electricity in (i) "The Production and Utilisation of Power," Mr. J. S. Highfield; (ii) "Transport," lecturer to be announced later; (iii) "Communications," Sir Oliver Lodge; (iv) "The Household," Miss C. Haslett and Mr. Ll. B. Atkinson.

(A limited number of tickets of admission to these two meetings will be obtainable in August from the secretary, I.E.E., Savoy Place, Victoria Embankment, London, W.C.2.)

Afternoon alternative visits to (*a*) the Brookman's Park transmitting station of the British Broadcasting Corporation; (*b*) the Post Office's electric tube railway, Camden Town, and the electrical installation in the reptile house at the Zoological Gardens; (*c*) the Deptford power stations of the London Power Co., Ltd.; (*d*) the P.O. Holborn automatic and the Carter Lane trunk telephone exchanges and the transatlantic radio-telephone service terminal; (*e*) the Chiswick repair works of the London General Omnibus Co., Ltd.; (*f*) the cigarette factory of Carreras, Ltd., at Camden Town and the Zoo reptile house electrical installation; (*g*) the tea and chocolate factory of J. Lyons & Co., Ltd.

In the evening the annual I.E.E. conversazione will be held at the Royal Albert Hall.

Wednesday, September 23rd—Faraday Exhibition at the Royal Albert Hall (see next column).

Thursday, September 24th—whole-day excursions (*a*) to Oxford by train, morning tour of colleges and afternoon visit to Cowley works of Morris Motors, Ltd.; (*b*) to Chelmsford by train, morning visit to works of Marconi's Wireless Telegraph Co., Ltd., and afternoon tour of works of the Hoffman Manufacturing Co., Ltd.; (*c*) to Gravesend by road, morning visit to W. T. Henley's Telegraph Works Co., Ltd., and afternoon trip to the Swanscombe 132-kV transforming station of the Central Electricity Board, Eltham-Deptford grid line, and 66-kV transforming station in the London area; (*d*) to Barking by road, morning inspection of power station of County of London Electric Supply Co., Ltd., afternoon river cruise on s.y. *St. Katharine* to Port of London Authority's docks; (*e*) to Windsor by train, morning inspection of Castle and St. George's Chapel, and afternoon train trip to Reading biscuit factory of Huntley & Palmer's, Ltd.; (*f*) to Teddington by road, morning tour of the National Physical Laboratories, and afternoon at Hampton Court Palace and grounds; (*g*) half-day (morning only) trip to Barking power station of County of London E.S. Co., Ltd.; (*h*) half-day (afternoon only) trips either to the Cadby Hall bakery and food-stuffs factory of J. Lyons & Co., Ltd., or the Croydon air port.

Friday, September 25th—whole-day visits by road (*a*) to works of the General Electric Co., Ltd., morning at Hammersmith M.O. lamp and valve factory and afternoon at Wembley No. 7 lamp factory, glass works, and research laboratories; (*b*) to Erith, morning at Callender's Cable Co., Ltd., and afternoon at Fraser & Chalmers, Ltd.; (*c*) to Woolwich, morning at Siemens Brothers & Co., Ltd., afternoon at Messrs. Bowater's Northfleet paper mills; (*d*) to Acton, morning at the carriage works of the London Underground Railway Co., Ltd., and afternoon to Hayes, either the Gramophone Co., Ltd., or the British Electric Transformer Co., Ltd.; (*e*) morning visit to the Brimsdown power station and "Northmet House," Southgate, of the North Metropolitan Electric Power Supply Co., Ltd., and afternoon trip to the Post Office's radio station at Baldock.

In the evening there will be an I.E.E. reception and dance at one of the two new Park Lane hotels.

The Faraday Exhibition

The Institution of Electrical Engineers will be responsible for the Centenary Exhibition, which is to be held at the Royal Albert Hall, and is providing the necessary funds for its organisation, in which the Central Electricity Board and the principal associations connected with the electrical and chemical industries are co-operating. Many novel exhibits are being designed to demonstrate in a practical manner the benefits that have followed from Faraday's great discoveries. The display is to be formally opened to the public by Lt.-Gen. the Rt. Hon. J. C. Smuts on September 23rd, and it will remain open until the evening of October 3rd. Showcases containing Faraday's personal relics will be the central feature of the Exhibition, and on adjoining stands will be reproductions of his more important experiments arranged by the Royal Institution, where Faraday lived and worked, the remainder of the display depicting modern applications of electricity and those sections of the chemical industry which owe their origin to his investigations. Members of the I.E.E. and delegates to the centenary meetings will have opportunities of viewing the show privately during the conversazione and next morning (tickets obtainable in August), as will also those taking part in the meetings of the British Association as outlined below.

The British Association

As we have already stated, this year's meeting of the British Association for the Advancement of Science marks the Association's hundredth anniversary. In 1831 Sir David Brewster, F.R.S., proposed to John Phillips, the geologist, who was secretary of the Yorkshire Philosophical Society, that a meeting should be held in York, as a convenient geographical centre, to establish a "British Association of men of science." A gathering of 353 assembled and the B.A. was duly formed. Faraday's discovery, which is the subject of the September celebrations, was made about a month before the inaugural meeting of the Association; it is therefore fitting that the Association's centenary celebrations should be linked up with the general tribute to Faraday's work. For this reason the meeting is to be held in London, from September 23rd to 30th, instead of York, the birthplace of the Association. The latter city will be visited next year when the Association commences its second century.

The president of the British Association is usually a leading scientist, or occasionally an eminent engineer, but from time to time a personality prominent in national affairs accepts the position. Such is the case this year, when General J. C. Smuts, F.R.S., will preside. The presidential address will be delivered on September 23rd at the Central Hall, Westminster.

Sir J. Alfred Ewing, K.C.B., F.R.S., this year's president of the Engineering Section, is a leading civil and mechanical engineer and has published many scientific papers, especially on magnetism and the physics of metals, among them being one on "Magnetic Induction in Iron and other Metals." In 1895 he was awarded the Royal Medal for his researches in magnetism. The subject of Sir Alfred Ewing's address will be "Power," including the thesis proposed by Sir Frederick Bramwell in 1903 to deal with "the whole question of the prime movers of 1931, and especially with the then relation between steam engines and internal-combustion engines." The proceedings of the Engineering Section will also include papers and discussions on Faraday's metallurgical work. The meetings of the section will be held at the City and Guilds Engineering College, South Kensington. The Economic Science and Statistics Section will discuss rationalisation, wages, prices and unemployment; foreign trade; international agreements and a number of other subjects of vital importance. The presidential address of Brig.-Gen. Sir Harold Hartley, C.B.E., F.R.S., before the Chemistry Section will bear the title "Michael Faraday and the Theory of Electrolytic Conduction."

Our Industry's Debt to Faraday

Sir Richard Gregory, speaking at the dinner of the Chemical Engineering Group of the Society of Chemical Industry in London, recalled that Faraday's discovery of the relation between magnetism and electricity, for which no one would have paid him a shilling, had created industries in which hundreds of millions of capital had been invested. Britain was now the chief exporting country of electrical machinery and apparatus, her total exports being valued at about £20,000,000. In these days of world-trade depression it was worth while, he said, to remember for the credit of science that one of the few industries unaffected by it was the radio industry, the latest development of electrical engineering.

Other references to Faraday and his work will be found on pages 745 and 758 of this week's issue.

Some Views of the Buenos Aires Exhibition

1. Crompton Parkinson motor generators in sub-station. 2. Petters, Ltd. 3. A corner of the G.E.C. stand. 4. Tudor house with Henley pillar in foreground. 5. S. Smith & Sons (M.A.), Ltd. 6. The British Insulated Cables stand. 7. I. Calvete, Ltd. 8. Reavell & Co., Ltd. 9. The Shell-Mex Building at night.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Lamp Price Reductions

In this issue the Electric Lamp Manufacturers' Association announces further reductions in the price of electric lamps made by its members. These reductions apply to 75, 100, and 150-W clear, pearl and opal lamps for standard voltages and amount to 3d. in all cases but one. The brands affected are "Cosmos," "Cossor," "Cryselco," "Elasta," "Mazda," "Orion," "Osram," "Philips," "Royal Ediswan," "Siemens," "Stella" and "Tungsram." The last reductions were made in September last.

In connection with these price reductions, the Z ELECTRIC LAMP & SUPPLIES CO., LTD., has issued a useful discount indicator for use by retailers of "Z" lamps. This is a very ingenious and serviceable device.

Imports and Exports: Volumes and Values

Last week's *Board of Trade Journal* contained the customary quarterly article equating volumes and values of imported and exported goods to 1924 figures. The period covered was the first quarter of the current year and as regards retained imports of electrical goods and apparatus it was shown that while declared values rose from £633,000 in January-March, 1924, to £1,167,000, the actual rise, employing 1924 values, was to £1,620,000. The quantity of these imports was thus 255.9 per cent. of the 1924 volume. In the case of exports, however, there was an actual fall in declared values—from £2,336,000 to £2,294,000. Converted to 1924 values this figure is raised to £2,592,000. Thus electrical exports during the quarter were only 111.0 per cent. of the 1924 volume. The figures for electrical machinery are not shown separately, but the statistics for machinery as a whole, treated in the same manner, give the following results: Retained imports, 167.9 per cent. of 1924; exports, 81.8 per cent.

A B.I. Cable Film

BRITISH INSULATED CABLES, LTD., has produced an interesting film showing the manufacture of paper- and rubber-insulated cables and accessories; the laying and jointing of cables; and the erection of overhead transmission lines. The various sections were taken at the company's Prescot and Helsby works, at Stratford-on-Avon, and in Scotland during the erection of the Central Scotland Scheme lines. The film has been shown to three large audiences of electrical engineers representative of all branches of the industry. The first exhibition was in Glasgow, and on the following day there were two "performances" in Newcastle.

The Marking of Imported Insulating Tape

An application by the Cable Makers' Association that all imported adhesive insulating tape for electrical purposes should be required to bear an indication of origin was heard by the Board of Trade Committee, under the Merchandise Marks Act, on Tuesday last. The only opponent was the Electrical Importers' and Traders' Association. Two members of the C.M.A., namely, W. T. Henley's Telegraph Works Co., Ltd., and the St. Helens Cable and Rubber Co., Ltd., have an annual production of about 160 tons of insulating tape whilst certain other firms outside the Association, but supporting the application, have an annual production of about 250 tons. It was contended that there is an extensive importation of insulating tape and not only the retail purchaser but also the retailer, in many cases, were unaware whether the supplies were British or foreign.

Evidence was given on behalf of the applicants by Mr. Ll. B. Atkinson, Director of the C.M.A., and by representatives of W. T. Henley's Telegraph Works Co., Ltd., who spoke specially as to the purchases of insulating tape being made at retail shops where the retailer was unable to state whether the tape in question was foreign or British. Mr. F. Pooley, of Messrs. Pooley & Austin, also gave evidence.

Mr. F. W. Challis, on behalf of the opponents, said that there was no objection in principle to a Marking Order; already the American makers, who were the largest suppliers, marked their tape. Objection was taken, however, to the proposed manner of marking. It appeared that, first, the cardboard boxes containing a large number of small rolls of tape would have to be marked, then the small box or container in which the tape was packed was to be marked, then the tin foil, and then the actual roll of tape itself. He contended that one mark would be sufficient in the case of all new goods coming into the country. There was good reason for exempting existing stocks altogether because insulating tape deteriorated after six months or so in stock, and therefore became unsaleable after that period. Mr. J. D. Dow, managing director of the Armorduct Cable Co., Ltd., gave evidence for the opponents.

Mr. W. B. Faraday, for the applicants, said that as regarded existing stocks he would be content to have the container in which the small roll was sold marked, or if it were sold without any covering then there should be a mark on the tape itself. As regarded new goods, however, he suggested there was no hardship to mark in the course of manufacture the cardboard boxes containing a large number of rolls of tape, then to mark the container of the individual roll the tin foil or other covering around the tape, and, finally, the tape itself by means of an adhesive label fixed to the bobbin on which the tape was wound, or to the side of the roll itself. The Committee is to report its decision in due course.

Central Board Contract

BRITISH INSULATED CABLES, LTD., has received an order from the Central Electricity Board for linking the N.W. England and N. Wales Section of the Grid scheme with the Liverpool area. The new line will connect up with the standard tower lines coming in from Preston and Warrington at Litherland. From this point it is to be brought into Liverpool along the Leeds and Liverpool Canal, the conductors being supported over the canal by means of lattice steel gantries. These structures will be 70 ft. high and will carry six steel-cored aluminium conductors and one earth wire. The approximate value of this contract is £86,000, and the survey work is now finished. It is hoped to complete the work by the end of the year. This contract follows closely upon the contract recently placed with the company by the Central Board for the erection of 132,000-V overhead transmission lines in the North-East England District. In this case the equipment will be the same as used on other sections of the national Grid schemes, and the value of the contract is approximately £200,000.

The South African E.D.A.

The Electrical Development Association for South Africa, about which some preliminary particulars were given in the ELECTRICAL REVIEW some time ago, was launched at Pretoria during the convention of the Association of Municipal Electrical Engineers. Mr. A. M. Jacobs, a member of the Electricity Supply Commission, addressed the convention on the subject, and said that much of the work that might have been done by such an association had already been successfully launched by the larger municipalities. Commander J. B. Bullock, chairman of the E.D.A. Committee, which recommended the formation of the Association, said that an encouraging amount of support was assured from large merchant firms, and this, with the amounts promised by the municipalities, the Electricity Supply Commission, and the Victoria Falls and Transvaal Power Co., Ltd., had given the committee reason to assume that £8,000 could be collected with which to start. Mr. G. Weyhausin, managing director of Siemens (South Africa), Ltd., had prepared a statement on the scheme which said that there might be possibilities of improving conditions for contractors who were prepared to join by establishing a branch of the E.D.A.

The Swedish Industries Fair

The Swedish Industries Fair is held annually in May. Nearly 1,000 Swedish industrial concerns are generally represented and about 100,000 purchasers from 25 different countries visit the Fair. This year the period is from May 9th to 17th. The exhibition is divided into two principal sections—the Industrial Fair and the Building Fair.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-Making Industry notifies us that there will be no "cost-of-living" alteration in wages on the third pay-day in May.

Motor Manufacturers Amalgamate

It is announced that two of the oldest firms of electric motor manufacturers have joined forces as from April 17th. These are NEWTONS OF TAUNTON and T. HARDING CHURTON & Co., Leeds. New London offices are being opened on May 4th at 3-5, Cavendish Place, Regent Street, W.1 (telephone: Langham 4311; telegrams: Guidepost, Wesdo), and the arrangements made will improve the service now given in respect of Harding Churton products in London and the south, and help to maintain the Newton service. The existing works at Taunton will be continued, and the sales office of Messrs. Harding Churton at Atlas Works, Leeds, will now be in a position to deal with Newton products.

Russian Electrical Imports

According to the official statistics of the foreign trade of the Soviet Union during the year ended September 30th last the imports of electrical machinery and appliances into Russia during that period attained a value of about £4,800,000, as compared with £3,300,000 in the preceding twelve months.

In a recent issue of *Commerce Reports*, Russian trade during 1929-30 is analysed to show the shares of a number of countries. The statistics indicate that Germany was the leading supplier of electrical equipment, having supplied 10,475 metric tons of electrical machinery and fittings in the year under review, against 8,227 tons in 1928-29. The United Kingdom is credited with having supplied 1,755 metric tons of this class of goods, against 1,010 tons in the preceding year. France's quota was

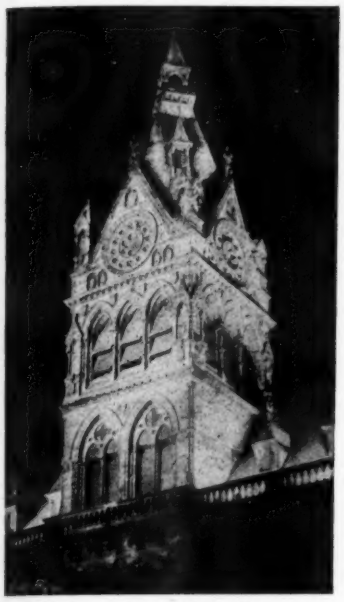
valued at $2,701,798, and it is noted that this included two large turbines and some radio equipment. The electro-technical equipment supplied by the United States is put at $1,449,378, but there is also an item "Post, telephone and telegraph" amounting to $1,360,243.

Price Reductions

Messrs. HEYES & Co., LTD., announce reductions in prices of certain types of "Wigan" prismatic and "Lacent" fittings.

Floodlighting at Chester

MR. S. E. BRITTON, the engineer and manager of the Chester Corporation Electricity Department, has sent us a photograph (reproduced herewith) of the tower of the Chester Town Hall as it appeared on the occasion of the re-opening of the electricity showrooms on April 22nd. The results of floodlighting the building were excellent, as will be seen, every detail of the stonework being clearly brought out.



Chester Town Hall Tower

Trade with Central America

Confidential memoranda on methods of trading and the appointment of agents in El Salvador and Nicaragua prepared by consular officials have been received in the Department of Overseas Trade and circulated to firms whose names are entered on its Special Register. British firms desirous of obtaining copies of the memoranda should apply to the Department, 35, Old Queen Street, S.W.1. Reference Nos. C.X. 3507 and 3508 should be quoted.

The Ecuador Machinery Market

A recent D.O.T. Consular report states that machinery and apparatus of all kinds, including agricultural and electrical, is a comparatively large item of Ecuadorean imports, representing in 1928 about 10 per cent. of the total imports. The value of such imports during that year was £365,854, of which £66,490 represented electrical machinery, apparatus and fittings. Of this total the United States supplied £218,082 and Germany £58,273. Great Britain's share was only £27,494. Belgium and Sweden each supplied about £27,000. Ecuador being a country where there are only a limited number of mechanical and electrical engineers, and in any case none engaged in commerce, it is very difficult for a manufacturer to obtain the services of a local agent with technical knowledge. There are, however, a few commission agents who, after many years of handling machinery, have acquired a fair knowledge of the trade, but in most cases these already represent German or American manufacturers. The reason why the British share in electrical machinery is very small is undoubtedly due to the fact that no local British enterprise exists in Ecuador either owning or controlling electric supply undertakings or prepared to erect new undertakings under contract for account of the Government or municipal bodies, and it is evident that unless British firms have the opportunity of constructing or controlling power plants in Ecuador there is little prospect of marketing large electrical machinery of British origin. The opening would appear to be limited chiefly to wire, fittings, small motors and generators and domestic and industrial appliances. Electricity is being increasedly employed in all parts of the country and the sale of domestic appliances such as irons, grills, heaters, kettles, and fans is likewise on the increase.

Southend Corporation and Contractors

At a recent meeting of the Southend-on-Sea Town Council the Electricity Committee recommended the institution of a scheme for the assisted wiring of premises, the sale and hire-purchase of electrical apparatus, and the provision of showrooms. It was stated that the electrical contractors' section of the local Chamber of Trade had agreed to the proposals on certain conditions, which included clauses to the effect that when a contractor effected the sale of a cooker, wash-boiler, or water-heater, to be provided by the Corporation and paid for under the hire-purchase system, the usual trade discount should be divided equally between the Corporation and the contractor; also that, with regard to sales at the showrooms, consumers were to be supplied at retail prices, and contractors at recognised trade prices, plus 5 per cent. Another recommendation was for the formation of a joint development committee, consisting of three members of the Town Council, three approved electrical contractors to be nominated by the Council of the Chamber of Trade, and one to be nominated by the British Electrical Development Association to act in an advisory capacity only, the objects being to form a closer relationship between the electrical installation contractors and the Corporation, to keep the contractors fully advised of the Corporation's activities and extensions, and to consider suggestions put forward which were likely to prove of mutual advantage to the contractors and the Corporation. In the discussion it transpired that the Chamber of Trade still adhered to its opposition to the establishment of a showroom in principle. Eventually the matter was referred back for further consideration.

For Sale

Preston Electricity Department invites offers for the purchase of d.c. meters.

(See our advertisement pages to-day.)

Social Events

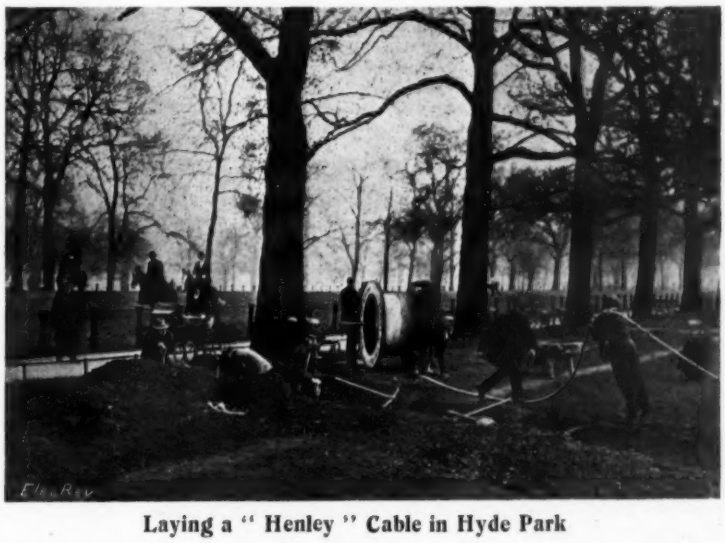
The Birmingham Electrical Golfing Society recently held its meeting at the Robin Hood Golf Club, Hall Green, Birmingham, the following being the results:—Medal round: C. F. Boyes, 80-4-76; W. T. Hellaby, 84-7-77; G. H. Westwood, 95-18-77. Four-ball eclectic: W. A. Millinger and J. R. Sayers, 69; J. Hamilton and D. Parkinson, 71.

The Cable Makers' Cup Final was played at Woolwich Stadium on April 13th, the contesting clubs being Anchor Cable Co., Leigh, and Liverpool Cable Co. Liverpool were the first to score, but the Anchor team won, after extra time had been played, by 4 goals to 2. The cup was presented to the winners by the Mayor of Woolwich, and in the evening the Cable Makers' Association entertained to dinner all the teams who had taken part in the competition, when a replica of the trophy was presented to Mr. J. Bowyer.

The Social and Sports Club of Messrs. Falk, Stadelmann and Co., Ltd., held a dance at Finsbury Town Hall on April 24th, over 100 members spending an enjoyable evening. A number of directors were present, including Mr. Max Falk, the chairman.

Henley's in Hyde Park

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., recently received a contract from the Office of Works for the supply and laying of a cable to provide power for the Serpentine swimming pavilion in Hyde Park. The accompanying picture shows the work in progress near Rotten Row. The supply comes from the Kensington and Knightsbridge Electric Lighting Company's main in Princes Street, and a joint was made inside the park railings near the Prince Edward Gate. Rotten Row then had to be crossed, and to allow the riders to enjoy their exercise, only half of the Row could be opened up at a time. The trench was dug, pipes laid and the trench filled in again before the other half was opened. There was then a straight run of about 300 yards across the football pitches. So that these pitches would be available for Saturday's play, the trench which was started on the Monday had to be dug, the cable laid and all filling in and cleaning up completed by the Friday evening. The cable again crossed the Row, the procedure being the same as for the previous crossing. The run then was straightforward down to the swimming pavilion.



Laying a "Henley" Cable in Hyde Park

Trade Announcements

The MORGAN CRUCIBLE CO., LTD., has entered into an arrangement whereby the sale of the "Morganite" system of radiant heating and of the "Electrorad" low-temperature panel system will be handled by the Electro-Gas Development Co., Ltd., 3, Arundel Street, W.C.2. Similarly the "Morganite" radiation thermostat and control apparatus will now be available for use with both systems. The two systems will retain their separate identities and the "Morganite" element will continue to be used. Complete continuity has been ensured by an exchange of staff and on and after May 1st, all communications should be addressed to the Electro-Gas Development Co., Ltd.

The ENTERPRISE MANUFACTURING CO. states that owing to mutual arrangements with the Vincent Switchgear Mfg. Co., Ltd., Birmingham, it ceased to act as London agent for the latter company on April 30th.

In order to carry adequate stocks of gasfilled lamps in addition to its usual stocks, BRITISH ELECTRIC LAMPS, LTD., has transferred its London stores to larger premises at Bell House, Berners Place, W.1. (Telephone: Museum 8902-03.)

The telegraphic address of the London offices of the Marconiphone Co., Ltd., is now "Marconifon, Rath, London."

An Electrical Exhibit at Olympia

The accompanying illustration shows the attractive stand of Messrs. FALK, STADELMANN & CO., LTD., at the Ideal Home Exhibition, Olympia. The exhibit is primarily on the decorative lighting side, and features the contemporary form of panel lighting. They are also showing a series of multiplate arm pendants with double and single ended tubular lamps, and

Falk, Stadelmann at Olympia

of a more decorative type with saucer-like shades, the metalwork in most cases being finished in chromium plate. There are also a series of hand-made decorative glass table lamps equipped for both direct and indirect lighting, and a further series exemplifying both systems of lighting treated in metal. Special demonstrations are given of the "Express" coffee machine.

New Catalogues and Lists

The MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, London, W.1.—The April issue of the "Marconiphone" monthly mail.

The METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Leaflet No. 306/3-1 describing, with numerous illustrations, "Metro-Vick" outdoor kiosk equipments.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, London, W.C.2.—A leaflet giving hints on separating stations with "Philips" radio receivers.

BRITANNIA BATTERIES, LTD., 233, Shaftesbury Avenue, London, W.C.2.—Catalogue "O," giving prices and particulars of "Britannia" tubular and flat plate type batteries for the lighting and starting of omnibuses and motor coaches.

The SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.2.—Two leaflets dealing respectively with soldering irons and toasters.

PARTRIDGE WILSON & CO., Davenset Works, Evington Valley Road, Leicester.—A leaflet describing a new "Davenset" auto charger for a.c. mains, designed particularly for re-charging motor-car starter batteries.

The LANCASHIRE DYNAMO & MOTOR CO., LTD., Trafford Park, Manchester.—A striking folder relating to a.c. and d.c. motors.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Catalogue P.263, giving particulars and prices of "B.I." knife switches.

The ELECTRIC CONSTRUCTION CO., LTD., Bushbury Engineering Works, Wolverhampton.—A price list (B.875) of "E.C.C." motor control panels for power factor improvement of squirrel-cage motors.

The BRUSH ELECTRICAL ENGINEERING CO., LTD., Falcon Works, Loughborough.—List No. 1012, describing the new "Brush-Falcon" geared turbine.

The AEROGRAPH CO., LTD., 43, Holborn Viaduct, London, E.C.1.—An illustrated catalogue describing the "Aerograph" spray-painting and finishing equipment.

The CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—A 46-page booklet, giving a list of "Exide" battery service stations at home and abroad.

The IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, London.—Leaflets Nos. 105 and 1035A, dealing respectively with "Igranic" self-acting motor startors and automatic star-delta startors.

The CENTURY ELECTRICAL CO., 1806, Pine Street, St. Louis, Missouri.—An illustrated leaflet giving details of "Century" reversible ceiling fans.

DRAKE & GORHAM WHOLESALE, LTD., 77, Long Acre, London, W.C.2.—Pamphlet No. 488, relating to the "Mirolux" street-lighting fittings.

FERRANTI, LTD., Hollinwood, Lancs.—A chart referring to the construction of the "Ferranti" d.c. mains screened-grid three-valve receiver.

The RAY ENGINEERING CO., Waterdale Works, Southmead, Bristol.—An illustrated catalogue of switchboards, switchgear, and instruments.

The A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, London, S.W.1.—London stock list of motors, switchboards, instruments, time-switches, meters, circuit-breakers, domestic appliances, &c.

The ENFIELD CABLE WORKS, LTD., 296-302, High Holborn, London, W.C.1.—Net price lists of "Enfield" v.i.r. and tough rubber-sheathed cables. Also leaflets relating to the "Enfelloy," "Enfelite," and "Enfelbond" wiring systems.

LANDIS & GYR, LTD., Elgee Works, Victoria Road, London, W.3.—A pamphlet giving particulars of type CF3 "Elgee" single-phase house service meters.

Recent Contracts

NORTHANTS ELECTRICAL INSTALLATIONS, LTD., Peterborough, has been given a contract to provide an electric lighting installation in the ancient Benedictine Abbey of Crowland, near Peterborough. The installation, which is to embody B.T.H. (Edison Swan) fittings throughout has been carefully planned to reveal the internal beauties of the edifice, which has been undergoing restoration for a number of years. It is intended that the scheme shall first come into use on the occasion of a service on the eve of the anniversary of St. Guthlac (the patron saint) during the summer.

In our issue of April 10th we referred to the inauguration by the Anglo-Portuguese Telephone Co., Ltd., of its new Trindade automatic exchange, Lisbon. The ALTON BATTERY CO., LTD., informs us that it supplied the battery equipment for this exchange, the main battery consisting of thirty "JMW 23/31" type "Alton" cells with an initial capacity of 1,670 Ah and an ultimate capacity of 2,276 Ah. The equipment was erected on site by the company's staff.

Messrs. FALK, STADELMANN & CO., LTD., have been entrusted (through their Dublin branch) with the order for the major portion of the electrical fittings for the Four Courts, Dublin, which, in the near future, will again be the centre of the Irish Free State judicature. In July, 1922, the buildings were almost entirely destroyed; the building has now been restored and is nearing completion. The principal architect to the Commissioners of Public Works of the Irish Free State, Mr. T. J. Byrne, A.R.I.B.A., F.R.I.A.I., is responsible for the reconstruction, and the architect in charge is Mr. W. H. Howard Cooke, A.R.I.B.A., M.R.I.A.I.

The London Electric Railway Co. has placed an order with the EQUIPMENT & ENGINEERING CO., LTD., for 139 "Chromalox" heaters.

The L.M.S. Railway Company has placed an order with the GENERAL ELECTRIC CO., LTD., for two 1,200-kW remote-controlled mercury-arc rectifiers with starting gear, for installation in the Upney Lane sub-station of the Barking-Upminster electrification scheme. These rectifiers will operate from an 11,000-V, 3-phase, 50-cycle supply, and will feed into the traction system at 630 V d.c.

Bankruptcy Proceedings

H. E. SANDELL, 1, Sandpit Lane, St. Albans, Herts., electrical engineer.—This debtor's public examination was held recently at St. Albans. A statement of affairs was returned which disclosed ranking liabilities of £912 and net assets of £35, leaving a deficiency of £877. The debtor attributed his failure to "lack of capital, losses on contract through under-estimating, bad debts, and costs of proceedings by creditors." The examination was adjourned. The following are the principal creditors:—

	£		£
Edison Swan Electrical Co., Ltd.	54	Sir A. C. Peake	78
Maybrook Electric Co.	53	Sloan Electrical Co., Ltd.	392

S. GILLETT (G.E.T. Electrical Supplies Co.), Lansdowne, 25 and 27, London Road, Hazel Grove, Cheshire, electrical goods dealer.—This debtor appeared for his public examination recently at the Court House, Stockport. His statement of affairs showed liabilities of £2,812 and assets of £340, leaving a deficiency of £2,472. He was formerly an engineer and contractor, trading at Newcastle-on-Tyne. In 1914 he formed a limited company, but in 1922 the business was wound up. He again commenced business but his stock was destroyed by fire and water. He commenced his last venture ten months ago with a capital of £75. In the first month he had a turnover

of £2000 and in October last it increased to £300. The debtor attributed his failure to lack of capital, inability to collect book debts, and local trade depression. The hearing was adjourned in order that the debtor might furnish a cash account.

S. COWEN (Imperial Radio Manufacturing Co.), wireless dealer, 43a, Barbican, E.C.—Receiving order made April 17th, on a creditor's petition. First meeting held April 30th; public examination, July 1st, at Bankruptcy Buildings, Carey Street, W.C.

E. BROWN (World's Wireless Stores), wireless dealer, 70, Morton Gardens, Wallington.—Receiving order made April 15th, on debtor's own petition. First meeting held, April 28th; public examination, May 21st, at the County Court, Scarbrook Road, Croydon.

F. V. HOWITT (The Falksley Company), electrical engineer, Riste's Place, Barker Gate, Nottingham.—First meeting held, April 29th; public examination, May 7th, at the County Court House, St. Peter's Gate, Nottingham.

T. J. HORN (Thomas Horn & Co.), electrician, 5, Harrogate Parade, Moortown, Leeds.—Last day for receiving proofs for dividend, May 7th. Trustee, Mr. H. C. Bowling, 24, Bond Street, Leeds, Official Receiver.

W. MANN, wireless dealer, 32, Briton Street, Leicester.—Last day for receiving proofs for dividend, May 6th. Trustee, Mr. E. Barlow, 1, Berridge Street, Leicester, Official Receiver.

J. LAZARUS AND M. LAZARUS (Langdons Radio), wireless and electrical dealers, 217, Golders Green Road, Golders Green, N.W.—Receiving order made April 22nd on a creditor's petition. First meeting, May 5th, and public examination, June 26th, both at Bankruptcy Buildings, Carey Street, W.C.

H. CAVANAGH, electrician, 19, Hampden Street, Salford.—Receiving order made, April 22nd, on debtor's own petition.

W. G. LESLIE (Carlisle Ignition Co.), electrician, St. Paul's Square, Carlisle.—First meeting, May 4th, at the Official Receiver's office, 18, Bank Street, Carlisle. Public examination, June 3rd, at the Court House, English Street, Carlisle.

W. F. FLINT, electrical engineer, 53, Jameson Street, Hull.—Application for discharge to be heard May 13th, at the Guildhall, Alfred Gelder Street, Hull.

Company Liquidations

LIGHT-O-DAY ELECTRIC LAMP CO. (1927), LTD.—The statutory first meetings of the creditors and shareholders were held on April 23rd at Carey Street, W.C., before Mr. H. P. Naunton, Official Receiver. A statement of accounts was lodged showing liabilities of £2,301 against assets of £394, and a deficiency of £10,955 with regard to contributories, the issued capital being £9,190. The chairman reported that the company was promoted by G. E. Byers and F. H. Edwards as a private company in 1927 to carry on business as an electric light company and in particular exploit the manufacture and selling rights in the United Kingdom of the "Oriona" daylight electric lamps. Byers was appointed managing director for five years at a salary of £520 per annum. He was made bankrupt in 1929 and had not yet applied for an order of discharge. The company also acquired the goodwill of a business carried on under the style of the "Light-o-Day Electric Lamp Co." The consideration for the purchase was £3,000 in shares and the payment of all liabilities of the vendor in relation to the business. Very little business was transacted before September, 1929, and the greater part of the subscribed capital was lost during the first year. The company was subsequently kept going by loans from the directors. On December 3rd, 1929, it entered into an agreement with Omega Lamp Works, Ltd., which agreed to supply the company with vacuum lamps marked "Light-o-Day" up to any quantity not exceeding 125,000 lamps per annum for treatment by the company's process. The company's failure was attributed to lack of capital. Mr. A. G. Stevens, 6, Broad Street Place, E.C., was appointed liquidator.

THOMAS & STINCHCOMB, 6, Narrow Wine Street, Bristol, electrical and wireless engineers.—The statutory meeting of creditors was held on April 24th at the offices of Messrs. E. T. Collins and Son, 28, Baldwin Street, Bristol. The statement of affairs showed liabilities of £1,493 and net assets of £418, leaving a deficiency of £1,075. Mr. Arthur Collins reported that one of the directors had a claim in respect of advances made during the last three years. The bank was unsecured so far as the company was concerned, but it held collateral security. The company was registered in April, 1925, with a capital of £2,000, to take over an existing business, and losses had been sustained in recent years; the deficiency was due to this. A resolution was passed confirming the voluntary liquidation of the company, with Mr. Collins as liquidator. A committee was also appointed, consisting of the representatives of Messrs. Simpson, Baker & Co., Ltd., Southern Factors, Ltd., and Helmore & Hunt.

KENSAL RADIO MANUFACTURING CO., LTD., 104-6, Chamberlayne Road, Kensal Rise, N.W.—The Official Receiver has issued a summary of the statement of affairs showing liabilities of £1,594, assets £164, and a deficiency of £1,884 with regard to contributories. The company was incorporated in November last as radio and radio-gramophone and electrical agents. The trading resulted in a loss of £1,369. The failure of the company is attributed to the cost of experimental work and slow production, which led to the cancellation of orders. In the opinion of the Official Receiver the failure is attributable to the mismanagement and incompetence of the directors. Mr. A. C. Vincent has been appointed liquidator.

ARGENTINE TRAMWAYS & POWER CO., LTD.—Winding up voluntarily. Liquidators, Messrs. D. W. Jack and F. L. Barry, 2, Rector Street, New York. The liquidators are authorised to transfer, for certain considerations, the entire assets and undertaking of the company as a going concern to Cia. Central Argentina de Electricidad, S.A.

WYE LIGHTING, HEATING & POWER CO., LTD.—Particulars of claims by May 9th to the liquidator, Mr. O. Ashby, 22, High Street, Whitstable.

MARLER & CO., LTD.—Winding up voluntarily. Particulars of claims by May 16th to the liquidator, Mr. J. D. R. Jones, Central Chambers, Newport, Mon.

Hire-purchase and Assisted Wiring

Mr. E. H. Jones, who presided at the half-yearly meeting of the North Wales and South Cheshire Local Authorities' Electrical Undertakings Association held at Rhyl, on April 22nd, suggested that more consideration should be given to hire-purchase, wiring schemes and showrooms. In the case of Rhyl it was stated that the Council's assisted-wiring scheme had secured a thousand consumers who would not otherwise have taken electricity.

Ideal Home Exhibition Luncheon

Over sixty persons were present last Tuesday at a luncheon at the Clarendon Restaurant, Hammersmith, given by the Household Appliances Section of the London Chamber of Commerce to Mr. F. E. Gordon, organising secretary of the Ideal Home Exhibition. Congratulating Mr. Gordon on the success of the Exhibition, Sir Frances Goodenough said that a record attendance was almost assured. Mr. L. J. Hydelman, in response to the toast of "The Household Appliances Section," said that the sale of household appliances offered great scope for development and that the country was behind America and the Continent in this respect. Manufacturers must realise that the only hope of increased trade was the education of the housewives. At the conclusion of the function an electric coffee percolator was presented to Mr. Gordon by Mr. G. E. W. Crowe, chairman of the Section.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price April 28th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5½d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Borax ... ... ,,	£17	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac T.N.... ... ... per cwt.	£4 5s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3½d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£85 to £90	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet and Foil ... ,,	1/1 to 2/9	...
b	Babbits Metal and Anti-friction Metals—		
	Grade I ... ... per ton net.	£107	£6 dec.
	Grade II ... ... ,,	£78	£3 dec.
	Grade III... ... ... ,,	£48	£1 dec.
c	Brass (rolled metal 2' to 12' basis) per lb.	7¾d.	½d. dec.
c	,, Tubes (solid drawn) ... ,,	9¼d. to 9¾d.	½d. dec.
c	,, Wire, basis ... ... ,,	8¼d.	½d. dec.
c	Copper Tubes (solid drawn) ... ,,	10½d.	½d. dec.
g	,, Bars (best selected) ... per ton.	£75	£2 dec.
g	,, Sheet ... ... ,,	£75	
g	,, Rod ... ... ,,	£75	
d	,, (Electrolytic) Bars ... ,,	£49 12s. 6d.	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£59 12s. 6d.	...
d	,, ,, H.C. Wire per lb.	7¾d.	...
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine ... ... ,,	nom	...
h	India-rubber, Para fine ... ... ,,	4½d.	...
i	Iron, Pig (Cleveland No. 3) ... per ton.	58/6	...
l	,, Wire, galv. No. 1, P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£13 10s.	15s. dec
g	Mercury ... ... per bot.	£22 7s. 6d. to £22 10s.	...
e	Mica (in original cases) small ... per lb.	6d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/1½d.	...
p	,, ,, drawn bars & rods ,,	1/0½d.	...
p	,, ,, rolled strip & sheet ,,	1/1d.	...
p	,, ,, wire ... ... ,,	1/0½d.	½d. dec.
o	Platinum ... ... per oz.	£5	5s. dec.
d	Silicium Bronze Wire ... ... per lb.	9½d.	...
r	Steel, magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£108 5s. to £109 5s.	£8 10s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	2/11d.	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Orminston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Electricity Supply

Lighting, Domestic, Power

Aberdare.—HOSPITAL INSTALLATION.—The executive of the Aberdare and District General Hospital has decided to install electric lighting and power.

Algeria.—NEW POWER STATION.—Good progress is being made by the Société Algérienne d'Eclairage et de Force with the erection of a new central power station with an ultimate capacity of 60,000 kW at the port of Algiers. The initial plant will consist of two 12,000-kW turbo-generators.

Argentina.—BUENOS AIRES.—According to the report of the Compania Hispano-Americana de Electricidad (Chade), the output of the power stations of the company and its affiliated undertakings in the city and province of Buenos Aires amounted during 1930 to 829,012,258 kWh, as compared with 752,536,455 kWh in the preceding twelve months, an increase of approximately 10 per cent. During the same period the number of consumers increased from 430,000 to 461,289. At the Port power station in Buenos Aires a third 52,500-kW turbo-generator set is expected to be ready for operation by July next, and an order for a fourth set of similar capacity to be ready for service in 1933 has recently been placed. Among the power supply contracts recently secured by the Chade Co is that for the requirements of the electrified sections of the Western and Southern Railways, to commence at the end of the current year.

SANTA FÉ.—A new municipal power station will shortly be commenced to provide for the increased electricity consumption in the city. It was at first proposed that the Compania Argentina de Tranvias y Fuerza, which owns a large modern power station capable of supplying the entire community, should purchase the municipal plant; for this it offered 5,000,000 pesos (paper), agreeing also to reduce the tariff. Owing, however, to the long delay in accepting the offer, the company has withdrawn its proposal.—*Reuter's Trade Service* (Santa Fé).

Australia.—BRISBANE.—We have received from Mr. J. H. Hindman, manager of the City Electricity Supply Department, a copy of the annual report of the undertaking for the year ended December 31st last. The total revenue showed a decline from £263,633 to £255,579, but the working expenditure also fell from £182,311 to £166,314. The gross profit amounted to £89,264, an increase of £7,942 as compared with the preceding year's figure. Interest and depreciation absorbed £75,419 (£65,763 in 1929), which left a net profit of £13,846, as against £15,559 in 1929. During the year £108,036 was spent on capital account, making the total expenditure on the undertaking £890,913. Sales of electrical energy increased from 13,683,409 to 16,217,616 kWh and the maximum demand from 6,192 to 6,936 kVA. During the year under review 2,830 additional consumers were connected. A reduction was made in the rates for industrial power and cinema lighting, and a sum of £20,000 is being handed over from the accumulated profits of the Department to assist the Council in the relief of rates.

NEW ELECTRICAL TERMINAL STATION.—The *Melbourne Argus* says that distribution lines to all the eastern suburbs have now been transferred from Yarraville terminal power station to the new terminal at Richmond. The two metropolitan terminals are so interconnected that either can take the full metropolitan load in an emergency. The second main transmission line from Yallourn, although not yet in use, is available for immediate use should a fault develop in the other line.

Basingstoke.—ELECTRICITY SUPPLY FOR BRAMLEY.—The Town Council has applied for sanction to a loan of £3,600 for the extension of the electricity supply to Bramley.

Bexhill-on-Sea.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to loans of £1,192 for mains and £1,528 for plant.

Birmingham.—ELECTRIC HEATING OF CHURCH.—A new Wesleyan church, which is being built at Stetchford, and will seat 570 people, is to be heated electrically.

Blackpool.—LOAN FOR CABLES.—The Corporation Electricity Committee has decided to apply for sanction to a loan of £85,000 for cables.

INQUIRY.—A Government inquiry was held at Blackpool last week into the question of erecting towers for the electricity scheme from Preston to Fleetwood. The inspector heard objections of landowners on whose property it was proposed to erect the towers. In one instance it was stated that a large tower was to be erected at Little Marton on land intended for building. The decision of the Ministry of Transport will be issued in due course.

YEAR'S WORKING.—The annual report of Mr. C. Furness, borough electrical engineer, shows an increase of 3,851,562 kWh of electricity consumed during the year. Energy purchased from Preston amounted to 38,326,532 kWh as against 28,995,550 kWh, and that generated locally 6,551,480 kWh as against 12,030,990 kWh. The total of 44,878,012 kWh generated and purchased included 20,700,000 kWh for light, power, &c., an increase of 2,325,161 kWh. During the year 1,916 new connections were made and 25 miles of mains and distributors were laid. The net surplus after providing for capital charges is estimated at £35,500. The number of consumers has increased from 19,044 to 20,960.

Brighton.—POWER SUPPLY FOR SOUTH MOULSECOOMB.—The Corporation General Purposes Committee has agreed to the installation of a power supply in certain houses on the South Moulsecoomb estate.

CANVASSING SCHEME.—At a meeting of the Corporation Electricity Committee held recently, the engineer reported on the possibilities of developing the use of electricity, particularly with regard to heating and cooking. He recommended that, in conjunction with the assisted-wiring and hire-purchase schemes which have been adopted by the Council, an effort should be made to increase the sale of electricity by personal canvass throughout the whole of the area of supply. The Committee agreed to this suggestion and the present staff will be augmented in order to conduct the canvass and to follow up the results.

Bury.—MAINS EXTENSIONS.—The Corporation Electricity Committee recommends that application should be made for sanction to a loan of £20,000 for mains.

Canada.—ST. LAWRENCE POWER DEVELOPMENT.—The Quebec Government has granted the Beauharnois Light, Heat and Power Company permission to divert an additional flow of water from the St. Lawrence River in order to enable the company to develop a larger output of electricity at the power plant 25 miles above Montreal. The additional diversion of water from Lake St. Francis through the large new power canal now under construction has also been authorised by the Government after representations that the company is in negotiation with clients proposing to establish industries in the province requiring an additional 135,000 h.p. of electrical energy.

Clitheroe.—PROPOSED SUPPLY TO PENDLETON.—The Corporation is to be asked upon what terms it would be prepared to supply electricity to the parish of Pendleton.

Continental.—SWEDEN.—Ninety per cent. of the hydro-electric power resources of Sweden are to be found in the province of Norrland, according to an official report by Mr. R. Melin of the State Hydrographic Department. A survey of the total amount of Sweden's water-power shows that the country possesses 15.8 million h.p. at an average rate of flow and 2.9 million h.p. at the minimum rate. It has been found that at average water level the Swedish Norrland preponderates as a source of power, whilst at low level southern Sweden ranks first owing to the great resources of water power of the Venern Lake, the second biggest inland water basin in Europe. The most important Swedish river is the Lule River, the capacity of which is estimated at 14.5 per cent. of Sweden's total power. Next comes the Indal River with 11.5 per cent. and the Dala River with 7.6 per cent., while the other rivers in the Swedish Northland represent only 5 per cent. of the total. After Norway, Sweden possesses the greatest national water power resources in Europe.

ITALY.—According to *L'Energia Elettrica* the capacity of the electric power plants in operation in Italy at the end of January last amounted to 4,343,000 kW, as compared with 4,053,000 kW at the corresponding date of 1930, an increase of about 7 per cent. Of the total, hydro-electric plants are responsible for 3,562,000 kW and steam and internal-combustion engine stations for 781,000 kW. The output of electricity in Italy during January last is estimated at 779,187,000 kWh, as against 852,897,000 kWh in January, 1930, a decrease of 8.64 per cent.

FRANCE.—La Société des Forces Motrices de la Truyère has recently completed the first of two 220,000-V transmission lines which are being established between Marèges (Central France) and Paris. A second line will be completed this year and later one at the same pressure is to be erected between Marèges and St. Etienne.

NORWAY.—According to the recently-issued report for 1929 of the Norwegian State Inspectorate of Electric Power Plants, there were 2,222 electricity generating installations in Norway at the end of that year, representing a total capacity of 1,690,512 kW, as compared with 2,149 and 1,686,256 kW, respectively, at the end of 1928. The number of electric motors in use in the country increased from 80,354 (582,964 kW) to 85,759 (645,657 kW) and the number of electric lamps from 5,934,289 to 6,103,410. Power to the extent of 721,317 kW was employed for the operation of the electro-chemical industry, as against 675,973 kW in the previous year. The length of the h.p. mains in Norway increased during the year from 12,217 to 12,268 miles, and the l.p. network from 17,107 to 17,407 miles.

ESTHONIA.—The Standard Industrial Trust, Ltd., has just obtained from the Esthonian Government a concession allowing it to develop the falls on the Narva River. The company intends to invest £5,000,000 in the scheme which provides for the distribution of electrical energy all over the country.

FINLAND.—A proposal has just been submitted to the Finnish Government whereby it is proposed to develop, on a large scale, various industrial and hydro-electric plants in that country. The scheme would be financed by the Société Financière de Transport et d'Enterprises Industrielles (Sofina). The first part of the scheme proposes to extend the Imatra hydro-electric plant to double its present capacity and later to develop a number of other falls. Plans have also been prepared for several industrial plants, which will utilise the energy thus developed. In all, the scheme would cost about £6,000,000, while the total capacity of the proposed new plant would be approximately 600,000 kW. The estimated annual value of the products would be about £4,000,000.

Croydon.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to a loan of £40,430 for switchgear for a new switchhouse and the Southern Railway supply.

NEW SUB-STATION.—The Committee is to erect a sub-station to supply the Kynaston Road estate, at a cost of £1,280.

Derby.—ASSISTED-WIRING SCHEME.—At a meeting of the Town Council held recently, it was stated that 240 applications had been received for installations under the assisted-wiring scheme. Over 100 installations have already been completed.

Dover.—FLOODLIGHTING SCHEMES.—The Town Council is considering schemes for the floodlighting of Dover Castle and the municipal buildings.

Exeter.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £30,000 on account of the £50,000 applied for in respect of expenditure on mains and services.

HIRE-PURCHASE SCHEME FOR IRONS AND WASH-BOILERS.—The borough electrical engineer has been authorised to supply electric irons and wash-boilers on hire or on the hire-purchase system.

NEW SUB-STATIONS.—New sub-stations are to be provided at Mount Pleasant, Topsham Barracks, and Wear estate.

Grimsby.—LOAN.—The Corporation Electricity Committee recommends that application should be made for sanction to a loan of £33,988 for transmission cables, transforming substations, and other distribution works required to give a supply of electricity to Great Coates, Healing, Stallingborough, Immingham, and Keelby.

Haydon Bridge (Northumberland).—ELECTRICITY SCHEME.—A meeting of the Parish Council is to be called to discuss the question of obtaining a supply of electricity from the Newcastle-upon-Tyne Electric Supply Co., Ltd.

Japan.—HYDRO-ELECTRIC DEVELOPMENT.—The I.G.R. has decided to start work this year on its Shinano-gawa hydro-electric scheme. The work will take nine years to complete.

Kempton Park.—PUMPING PLANT.—The Metropolitan Water Board is to install at the Kempton Park works two steam turbines each driving two centrifugal pumps, at an estimated cost of £32,000.

Llandyssil.—ELECTRICITY SUPPLY FORTHCOMING.—The North Wales Power Co., Ltd., has informed the Parish Council that the main transmission line between Welshpool and Newtown will pass through the parish. The maximum charge for lighting will be 8d. per kWh, with other tariffs down to 1d. per kWh for heating and cooking.

London.—STOKE NEWINGTON.—The Borough Council Electricity Committee recommends the following adjustments in charges:—Free wiring installations: A reduction from 6½d. to 6d. per kWh. Lighting, power and domestic tariffs: A reduction from 1d. to ¾d. in the secondary charge of all two-part and domestic tariffs. Power: ¾d. per kWh for all energy consumed in excess of 50,000 kWh per annum. The Council in approved cases will provide and fix a suitable electric cooker and kettle complete with control gear and wiring up to 60 ft. in length and charge either (*a*) a quarterly rental of 7s. 6d. payable in advance, plus a charge for electricity of 1d. per kWh; or (*b*) an inclusive charge of 1½d. per kWh, the supplies to be given through prepayment meters.

STEPNEY.—The Borough Council Electricity Supply Committee recommends that application should be made for sanction to the following loans: £142,800 for prospective expenditure on e.h.p. and l.p. cables, distributing mains, and house services; and £276,200 for buildings, switchgear, sub-station equipment, station battery and enlargement of the coal store, in connection with the proposed extension of the Limehouse generating station.

POPLAR.—The Borough Council Electricity Committee has obtained sanction to the borrowing of £2,966 for the installation of oil burners and additional coal-handling plant.

LIGHTING OF HOSPITAL.—The Mental Hospitals Committee of the London County Council recommends the installation of electric lighting at the Banstead Mental Hospital by direct labour at an estimated cost of £19,000.

Luton.—LOANS SANCTIONED.—The Town Council has received sanction to loans of £15,897 for mains, and £2,315 for sub-station equipment for the supply to Markyate, Stopsley, &c.

Northern Ireland.—THE ELECTRICITY SUPPLY BILL.—In the Parliament of Northern Ireland on April 21st when the Committee stage of the Electricity Supply Bill was resumed, Major Hall Thompson moved an amendment prohibiting the Electricity Control Board from selling electrical fittings to consumers. The Rt. Hon. Milne Barbour, Minister of Commerce, said that every local authority in Great Britain engaged in distribution had power to sell fittings. The fact that the Control Board would be able to sell fittings would enable it to proceed more rapidly with the work. He considered that the right of the Board to sell fittings was absolutely essential to the success of the undertaking. The amendment was defeated without a division.

BELFAST.—It is estimated that a total of £257,000 will be required by the Corporation Electricity Department during the year ended March 31st, 1932, for the development of the undertaking.

North Wales and South Cheshire Joint Electricity Authority.—QUARTERLY MEETING.—It was announced at the quarterly meeting of the authority held at Llandudno, that the extension of the North Wales Power Company's transmission system from Bangor to Holyhead would be commenced forthwith and would probably be completed by August. Mr. Arthur Hewitt, who presided, said the L.M. & S. Railway Co. had entered into a contract for a supply to its Holyhead works but that the negotiations for a bulk supply for the Holyhead U.D. Council were not completed. In the Welshpool to Newtown area a preliminary survey had been made and wayleaves were being dealt with. The Power Co. had been asked by the Newtown Urban District Council to undertake the distribution of its electricity. The company would submit its proposals for the approval of the authority, which, in turn, would seek the approval of the Electricity Commissioners.

Norwich.—POWER STATION EXTENSIONS.—Subject to the consent of the Electricity Commissioners, the Town Council has decided to provide additional plant at Thorpe power station at a cost of £102,000, inclusive of structural alterations. Arrangements are being made for the station to be taken over by the Central Electricity Board on October 1st next.

Okehampton.—NEW POWER STATION.—The Town Council has approved plans for the erection of a new power station by the Okehampton Electricity Supply Company.

Preston.—PETITIONS FOR ELECTRICITY SUPPLY.—The Corporation Electricity Committee has received petitions from Hambleton and Rawcliffe-with-Tarnacre asking for a supply of electricity. The engineer is to prepare a report on the matter.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

HOLMFIRTH (HUDDERSFIELD).—Two-part tariff: "Unit" charge from 1d. to 1¾d. Small power consumers: From 3d. to a sliding scale of 3d. to 1½d. per kWh. Refrigerating: From 3d. to 1d. per kWh.

WESTON-SUPER-MARE.—Cooking and heating: A reduction from 1¾d. to 1½d. per kWh for the first 100 kWh a quarter and from 1½d. to 1¼d. per kWh above 100 kWh. For consumers using electric cookers of 5-kW capacity the charge will be 1d. per kWh.

LEWES.—*The Lewes and District Electric Supply Co., Ltd.*—Cooking, heating, and domestic supplies: From 2½d. per kWh for the first 100 kWh per quarter and 1½d. beyond, to 2d. and 1¼d. per kWh respectively. Where an electric cooker of 5-kW capacity or over is used the secondary charge is to be 1d. per kWh.

MID-SURREY.—*South Metropolitan Electric Tramways and Lighting Co., Ltd.*—Lighting: From 7d. to 6d. per kWh.

Shardlow.—EXTENSIONS.—The Rural District Council has approved plans submitted by the Derbyshire and Nottinghamshire Electric Power Co. for the construction of overhead and underground transmission lines in the parish of Swarkestone.

Southend-on-Sea. — ILLUMINATION SCHEME. — The Town Council has directed the borough electrical engineer to carry out electrical illuminations at the gardens, east and west of the pier, at an estimated cost of £1,449.

Swanscombe.—ELECTRICITY CHARGES.—The Urban District Council has decided to request the London and Home Counties Joint Electricity Authority to consider on its behalf the question of obtaining a reducion in the price of electricity in the district.

Tiverton.—HOSPITAL INSTALLATION.—The Tiverton Joint Hospital Board has accepted the offer of the Borough Council to extend its electricity mains to the hospital and has decided to invite tenders for wiring, fixtures, &c.

United States.—SECOND SOUTH CAROLINA HYDRO-ELECTRIC TAX BILL REJECTED.—*Power* states that the South Carolina House has rejected a Bill proposing to levy an excise tax of three-tenths of a mill per kWh on all hydro-electric power generated within the State. The House had previously rejected a similar measure, following which a new Bill with a lower tax rate was introduced.

West Hartlepool.—OPPOSITION TO BILL WITHDRAWN.—The Cleveland and Durham County Electric Power Co., Ltd., has withdrawn its opposition to the Corporation's Parliamentary Bill, one of the main objects of which is the extension of the area of the supply of electricity.

Weybridge.—ELECTRICITY UNDERTAKING TO BE PURCHASED.—At a recent meeting of the Urban District Council it was announced that a committee of the London and Home Counties Joint Electricity Authority had passed a resolution agreeing to purchase the local undertaking. As a result, the charge for electricity in the district would be reduced from 8d. to 6.05d. per kWh from June next.

Whickham.—ELECTRICITY SUPPLY.—Owing to the refusal of the Marley Hill Chemical Co., Ltd., to reduce the price for electrical energy supplied to the Urban District Council, it has been decided that the Sanitary and Highways Committee should consider the establishment of an electricity distribution station for the purpose of supplying electricity for the various services of the Council.

Yarmouth.—LOANS SANCTIONED.—The Town Council has received sanction to loans of £26,350 for general electricity purposes, £1,000 for the re-wiring of the Corporation pier and gardens, and £479 for the lighting of Hall Quay.

Traction

Blackburn. — PROPOSED LIGHT RAILWAY SCHEME. — An interesting suggestion has been made regarding the famous and very steep Pendle Hill. The proposal is for the construction of a light railway, the electricity to be generated by the wind at the summit of the hill. A test of the wind pressure carried out with the aid of a special device gave the definite conclusion that sufficient electricity could be generated not only to sustain the demands of a light railway, but also to provide the villages of Barley and Roughlee with ample electricity for domestic purposes. People in Pendle Forrest district are prepared to support the venture financially, it is stated.

Dearne Valley.—EXTENSION OF TIME.—The Dearne District Light Railways Joint Committee is applying to the Ministry of Transport for an extension of the time limited for the completion of the light railways authorised by the Dearne District Light Railway Order until June 24th, 1932.

Japan.—NEW ELECTRIC RAILWAY.—A start will be made shortly on the construction of the new electric railway, 7¼ km. in length, at Takao.

Middlesex.—TRAMWAY EXTENSIONS.—Application is to be made to the Minister of Transport by the County Council for an Order authorising the extension of the tramway system along High Cross Road, Tottenham.

Oswaldtwistle.—TRAMWAY ABANDONMENT.—After being in operation for over 20 years the town's tramway service was discontinued on April 22nd. A through 'bus service from Accrington has been introduced.

Syria.—BEIRÛT.—In view of the general boycott campaign against the tramway and electricity companies, the directors of the tramways in Beirût have decided to close down for the time being; nevertheless, in agreement with the Government, considerable reductions of prices have been decided upon. The campaign is widespread and extends to Damascus, Aleppo, Alexandretta and Latakia.—*Reuter* (Beirût)

Tynemouth.—TRAMWAY ABANDONMENT.—The Councils of Tynemouth and Whitley Bay have been recommended by their respective surveyors to accept a lump sum based on 3s. 9d. a sq. yd. from the Tynemouth & District Electric Traction Co., Ltd., if the company abandons its tramway service in the area.

United States.—RAILWAY ELECTRIFICATION.—According to *Modern Transport*, contracts for about $7,500,000 worth of structural steel and accessories have been placed by the Pennsylvania Railroad. The material will be used in carrying out the railway's recently-announced $175,000,000 improvement programme, including the electrification of the lines between New York and Washington, D.C., and terminal improvements at Newark, N.J., and Philadelphia. Nearly half the steel ordered will be used in the electrification of the Pennsylvania lines between New York and Washington. The erection of the necessary structures to carry the power lines between the Pennsylvania Railroad's Sunnyside yard, Long Island, and Manhattan transfer, N.J., has been practically completed, and work will go forward immediately on the section between Manhattan transfer and Trenton, N.J., where the railway's present main-line electrification begins. The electrified line now extends from Trenton to Wilmington, Del. At the same time, work will also be begun on the Wilmington-Washington section.

Telegraph and Telephone

Australia.—WIRELESS TO PAPUA.—The new beam wireless service between Sydney, Australia, and Port Moresby, Papua, has been officially opened by Mr. Leonard Murray, official secretary to Papua. The new plant replaces one which was installed at Port Moresby in 1913, and eliminates the land line to Townsville, Queensland, from which the service was previously conducted.

Chili.—RADIO-TELEPHONY.—The British Postmaster-General announces that a telephone service is now available to Conception, San Antonio, Talca, Temuco, and a number of other towns in central Chili, in addition to Santiago, Valparaiso, and Vinadelmar. For calls originating in the Isle of Man and Northern Ireland an additional charge is made.

Germany.—AUTOMATIC TELEPHONY.—Messrs. Siemens and Halske have received an order for an automatic telephone exchange with 10,000 connections for Saarbrücken, forming the commencement of a larger automatic network in that area.

India.—TELEGRAPH MERGER.—It is understood that negotiations are nearing completion for the merging of interests in wireless and cable telegraph traffic in India. It is believed that the existing Indian Radio Telegraph Co. will increase its share capital for the purpose of securing entire control of Indian business. While it is understood that the majority of the directors at the India end will be Indians, Imperial and International Communications, Ltd., will have a substantial holding in the new company.—*Reuter* (Bombay).

Irish Free State.—TELEGRAPH SERVICE.—In Dail Eireann on April 22nd, in moving an estimate of £1,451,775 for the Posts and Telegraph Department, Mr. Heffernon, Parliamentary Secretary, said that the estimated expenditure for the year 1931-32 was £2,201,775. The estimated expenditure for the past financial year was £2,246,795, and there was, therefore, a reduction of £45,020. The telegraph branch was now the only service working at a loss. The estimated deficit was £127,400, compared with a deficit of £147,955 in 1929-30.

South Africa.—DURBAN TELEPHONE SYSTEM.—The South African Minister of Posts and Telegraphs has informed a deputation from the Durban Municipal Council that he will advise the Government to take over Durban's telephone system. A joint inquiry has been proceeding for some time, but the Minister proposes to end it. The delegation expressed its disapproval of the decision and it is stated that the Durban Council will contest the issue.

Radio

Bulgaria.—NEW STATION.—The country's first transmitter has been opened in Sofia. Messrs. Philips inform us that the station is installed in a bank building, has a power of 1 kW, a wavelength of 319 metres, and uses the call "Rodno Radio."

Continental Rivalry.—GERMAN-POLAND AMNESTY.—Diplomatic representations made by the German Ambassador in Warsaw have led to a truce between Germany and Poland, says *World-Radio*, according to which the formula drawn up by the wireless authorities on both sides and signed by Government representatives, runs as follows:—"Both transmitting companies pledge themselves in future to the utmost consideration so that their broadcasts . . . will not infringe in any manner the spirit of co-operation and understanding incumbent upon broadcasting in the fulfilment of its duty within the domain of international rapprochment."

Edinburgh Station.—NEW SITE.—The B.B.C. transmitter at Edinburgh, which has been situated at the Edinburgh University Buildings since 1924, has been transferred to new premises of the St. Cuthbert's Co-operative Association at Port Hamilton, where it will remain until it is replaced by the high-power Scottish regional station which is now being built near Falkirk.

Germany.—LICENCES.—The number of receiving licences in use increased by 222,172 during the first quarter of 1931, the total being 3,731,681 on March 31st, an increase of 6.3 per cent., which total includes 134,131 free licences issued to the blind, to disabled soldiers, and to the unemployed.

In the period October to December, 1930, some 258 persons were convicted for using receiving sets without licences; eight of them were punished for connivance only. In the same period of 1929 only 185 persons were found guilty of not having obtained licences. The total number of "pirates" found guilty during 1930 amounted to 944.

Irish Free State.—FINANCE.—In Dail Eireann on April 23rd Mr. Heffernan, Parliamentary Secretary to the Minister for Posts and Telegraphs, in submitting an estimate of £63,784 for broadcasting services, said that the estimate for the year 1931-32 was £78,784, an increase of £3,398 over the estimate for 1930-31. The expenditure for the past year showed a saving of £51,686, of which £48,000 was due to non-expenditure for the provision of a high-power station. The amount provided in all for its erection was about £65,000, out of a total estimated cost of £75,000, so that an additional sum of about £10,000 would be required during the following year. The expenditure on the Dublin and Cork stations showed a reduction of £1,200 over the last year. Revenue for licences this year was estimated at £14,000; customs' duty receipts at £30,000; and advertisement revenue at £1,000, leaving an estimated deficiency of about £58,000, due entirely to capital cost of the erection of the high-power station at Athlone. Some difficulty had arisen in conection with the purchase of the original site chosen for this station, and the larger provision this year was due to the delay that had taken place.

Italy.—NEW STATION.—The new Palermo transmitter on the island of Sicily is to commence testing this week-end and to be formally opened on May 24th. Its wavelength has not been decided upon yet, but may be about 200 m.; the station will eventually relay the Rome programme. The station is using 3-kW plant which was originally at Rome.

Licences.—FURTHER INCREASE.—Broadcast receiving licences in use in Britain totalled 3,626,186 at the end of March, 1931, an increase of 55,893 for the month.

Northern Ireland.—NEW REGIONAL STATION.—The B.B.C. is to proceed with plans for replacing the Belfast station by a new and more powerful Northern Ireland regional station some distance from the town.

Wireless Exhanges.—EDINBURGH.—An offer of Broadcast Relay Services, Ltd., to establish communal reception has been considered by a sub-committee of Edinburgh Corporation. A communication from the Post Office stated that its policy was opposed to the granting of a monopoly to any person, or firm, for broadcast relaying services in any particular district. No action was recommended by the sub-committee.

SHEFFIELD.—Applications have been made to the municipal Corporation for permission to start re-diffusion schemes. At Rotherham the necessary permission has been obtained, and a small scheme is already in operation at Dore.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Australia.—MELBOURNE.—June 9th. Posts and Telegraphs Department. Plug seat switches. (A. 10876.)*
May 26th. Lead covered multiple twin telephone cable. (A.X. 10892.)*
July 7th. Accumulator batteries. (A.X. 10893.)*

Boroughbridge.—May 11th. West Riding County Council. Installation of electric lighting at new school. Particulars from the education officer, County Hall, Wakefield.

Cheadle and Gatley.—May 12th. Urban District Council. 6,600-V truck cubicle. Specification from Mr. R. W. Willis, engineer and manager, 37, High Street, Cheadle (deposit £1 1s.).

Eccles.—May 9th. Sewage Disposal Committee. Pumps and motors required in extension of sewage disposal works. Specification (contract No. 5) from the borough engineer and surveyor, Town Hall (deposit £1 1s.).

Egypt.—CAIRO.—June 8th. Ministry of the Interior. Supply and installation at Guirguch of power station (generator capacity approximately 500 kVA) and distribution system. (A.X. 10870.)*
June 24th. Ministry of the Interior. Overhead line material including 81 tubular poles, 1,250 kilos of bare copper cable, 715 kilos of bare copper wire and 320 insulators. (A.X. 10891.)*

Erith.—May 15th. Urban District Council. Air-cooled transformers. (See this issue.)

Gainsborough.—Electricity Department. Lighting fittings for the Town Hall. (April 17th.)

Glasgow.—May 11th. Electricity Department. Cables and meters. (April 24th.)

Hastings.—May 8th. Electricity Department. Boiler fuel. (April 24th.)
May 11th. Cables. (See this issue.)

Hoyland.—May 10th. West Riding County Council. Electric lighting installation in several schools. Specifications from Mr. A. Rayner, 151, Cross Hill, Ecclesfield.

London.—CENTRAL ELECTRICITY BOARD.—May 11th. Construction of central control station building at Park Street, Bankside, for the South-East England Electricity Scheme. (April 17th.)
May 18th. Central indicators and telephones for the Central England Electricity Scheme. **(April 17th.)**
May 27th. Site works, foundation works, and buildings at Northampton, Ironbridge, Wolverhampton, Stafford, and Stoke-on-Trent for Central England Electricity Scheme. (April 24th.)
OFFICE OF WORKS.—May 8th. Mechanical and engineering labour in the Newcastle-on-Tyne, Leeds, and Southampton districts. (April 24th.)

Luddendenfoot.—May 16th. West Riding County Council. Installation of electric lighting at Council School. Particulars from Mr. A. Beilby, divisional clerk, Education Offices, Sowerby Bridge.

Manchester.—Electricity Department. May 6th. Cables. (April 24th.)
May 5th. Automatic telephone equipment (specification No. 303).
May 8th. 33,000-V switchgear for Barton and Stuart Street power stations (specification No. B.77).
May 8th. Electric passenger lift (specification No. 304).
Specifications (deposit £1 1s. each section) and form of tender from Mr. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

Middlesbrough.—May 6th. Electricity Department. Cables and meters. (April 24th.)

New Zealand.—July 2nd. Government Railways. 60-kVA static condenser. (A.X. 10898.)*

Oldbury.—May 9th. Education Committee. Electric lighting installation at Bristnall Hall Lane Council School. Particulars from Mr. F. Brooks, secretary, Education Offices, Church Square.

Portsmouth.—May 13th. Electricity Department. Cables. (April 24th.)

South Africa.—CAPE TOWN.—May 13th. Electricity Department. 6,000 yards of 3-core cable for 11,000 volts, and 13,000 yards of 4-core cable for 600 volts. (A.X. 10875.)*
PRETORIA.—May 22nd. Department of Posts and Telegraphs. 12 motor-driven ringing generators. (A.X. 10853.)*

Stoke-on-Trent.—May 13th. Electricity Department. A.c. meters. (April 24th.)

Switzerland.—BERNE.—May 13th. Swiss Federal Railways. Supply and erection at Rupperswill of a reserve 7,000-kW generating plant operated either by Diesel engines or steam turbines. Particulars (5 francs) from Abteilung für Elektrifizierung, Bureau No. 166, 43 Mittelstrasse, Berne. Tenders to General Direktion, Schweizer Bundesbahnen, Berne.

West Midlands.—May 13th. Joint Electricity Authority. 33,000-V overhead transmission lines, supported by steel towers. (April 24th.)

Uruguay.—MONTEVIDEO.—May 27th. State Electricity Works. 200,000 m. of copper conductor wire and 97,500 m. of copper cording with rubber insulation. Particulars (35 francs) from Dr. Ricardo Vecino, 41, Avenue de L'Opéra, Paris. (A. 10887.)*
June 18th. Electrical accessories. Particulars (90 francs) from Dr. Ricardo Vecino. (A. 10887.)*

---

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Bexhill.—Electricity Committee. Recommended:—
220-kW rectifier at Sutherland Avenue sub-station (£1,478).—Hewittic Electric Co., Ltd.
Feeder panel (£73).—Bertram Thomas.

Bury St. Edmunds.—Town Council. Accepted:—
Cable (£9,088).—Callender's Cable and Construction Co., Ltd.

Campden.—Rural District Council. Accepted:—
Installation of electric lighting at Council houses at Mickleton.—W. R. Amos.

Croydon.—Electricity Committee. Accepted:—
Transformer in connection with supply to Southern Railway (£3,700).—English Electric Co., Ltd.
Metering equipment (£271).—Ferranti, Ltd.
Recommended:—
Stack and wood troughing for cooling towers (£559).—Davenport Engineering Co., Ltd.

Dover.—Town Council. Accepted:—
H.p. cable for the supply to Whitfield (£1,652).—Kilpatrick and Son.

Grimsby.—Electricity Committee. Recommended:—
H.p. cable (£1,106).—Metropolitan Cables, Ltd.

Hornsey.—Town Council. Accepted:—
Electrical installation at Muswell Hill Library.—Alpha Manufacturing and Electrical Co., Ltd.

London.—DEPTFORD.—Metropolitan Water Board. Accepted:—
Meters in connection with electrical machinery being installed at pumping station (£231).—Ferranti, Ltd.
STEPNEY.—Electricity Supply Committee. Recommended:—
Switch truck (£120).—A. Reyrolle & Co., Ltd.

Manchester.—Electricity Committee. Accepted:—
Installation work under the prepayment wiring scheme for 12 months.—J. T. Shawcross; G. Currie; A. E. Sudlow and Co.; G. F. Latham; Faulkner & Co., Ltd.; G. M. Brewster; H. C. Taylor & Co.
Education Committee. Accepted:—
Electric lighting, &c., at schools.—Faulkner & Co., Ltd.; W. A. Shaw & Co.; S. H. Heywood & Co., Ltd.
Waterworks Committee. Accepted:—
Paper-insulated cable, joint boxes, &c.—Macintosh Cable Co., Ltd.
Bare copper and rubber-insulated cable.—W. T. Glover and Co., Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Switchgear, transformers, and kiosks required from time to time in connection with the change-over, not to exceed £10,000, and lamp columns, lanterns and accessories for lighting pier gardens (£850).—General Electric Co., Ltd.
Electric lighting scheme, bandstand stage (£157).—F. P. Richard & Co.
Vapour extractor, London Road generating station (£150).—Serck Radiators, Ltd.
Electric drill (£153).—S. Stone.
Shadowless lamp, hospital operating theatre (£78).—G Davidson.

Wimbledon.—Baths Committee. Accepted:—
Laundry machinery and works specified by borough electrical engineer (£258).—Rhodes & Westlake.

A New Prime Mover

On June 4th a paper is to be read before the Royal Society of Arts, London, by Mr. J. F. J. Malone describing a new form of prime mover and its uses, which new type of engine derives its power from the expansion and contraction of fluids; it will be fully demonstrated. The chair will be taken by Mr. Llewelyn B. Atkinson, M.I.E.E., A.M.Inst.C.E., a vice-president of the Society.

Forthcoming Events

INSTITUTION OF ELECTRICAL ENGINEERS.—*Meter and Instrument Section.*—Friday, May 1st. Institution, London. 7 p.m. "High-voltage Precision Measurements." Prof. W. M. Thornton. Saturday, May 2nd. Visit to Cambridge, including the works of the Cambridge Instrument Co., Ltd. *Scottish Centre.*—Friday, May 8th. Forrester's Hall, Dundee. 7.30 p.m. Faraday lecture. "The Birth of Electrical Engineering." Prof. W. Cramp. *London Students' Section.*—Friday, May 8th. Institution, London. 6.15 p.m. "The Development of the London Automatic Telephone System." Messrs. M. G. Holmes and L. F. Salter. Saturday, May 9th. 2.30 p.m. Visit to the Central Telegraph Office, G.P.O.

Wireless Section.—Wednesday, May 6th. Institution, London. 6 p.m. Informal discussion on "Technical Problems in Connection with Television." Introduced by Mr. C. O. Browne.

NOTTINGHAM SOCIETY OF ENGINEERS.—Monday, May 4th. 7 p.m. Visit to Nottingham Telephone Exchange.

INSTITUTE OF METALS.—Wednesday, May 6th. Institution of Mechanical Engineers, London. 8 p.m. Annual May lecture. "The Progress of Power Production." Mr. W. B. Woodhouse.

IRON AND STEEL INSTITUTE.—May 7th and 8th. Institution of Civil Engineers, London. Annual meeting. Thursday, May 7th. Connaught Rooms, Great Queen Street, W.C. 7 for 7.30 p.m. Annual dinner.

Our Service Department

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

"TROJAN" conduit.

Notes

The Origin of the Royal Institution

The luncheon of the Batti-Wallahs' Society held on April 22nd was the first occasion on which Mr. J. S. Highfield, the new president, occupied the chair.

Sir William Bragg, K.B.E., F.R.S., referring to the marine associations of the Society, mentioned Faraday's work in connection with the installation of electricity in lighthouses. Faraday, he said, was no mathematician, but his work had enabled Maxwell and Kelvin to translate into mathematical terms the theories of light and of the propagation of waves through the ether. His laboratory notes contained about one million words and their chief interest lay in the light they threw on how their author was feeling his way from day to day. They were the equivalent of "Pepy's diary" to electrical engineers. The period was characterised by an awakening consciousness of the difference in the modes of living between the upper and lower classes. Sir Benjamin Thompson, Count von Rumford (born in Massachusetts), who was keenly interested in the reduction of smoke among other activities, was a brilliant organiser and with the aid of the wealthy Bernard founded in 1798 the Royal Institution at a meeting at the house of Sir Joseph Banks. It was the first club not founded in connection with either politics or gambling and was, in fact, the first technical institute with the primary object of raising the status of the working classes. Sir Humphrey Davy was the first lecturer and Faraday became his assistant. Thus it was that Faraday's opportunities for patient exploration and thought were due to the fortunate combination of the staff officer, von Rumford, and the philanthropist, Bernard.

Mr. W. McLelland (past-president) proposed the vote of thanks to Sir William Bragg.

Association of Supervising Electrical Engineers

Arrangements have now been made for holding the fifth annual competition for the "Economic Premiums" inaugurated by Mr. Frank Gill, M.I.E.E., when president of the Association in 1925. The rules and questions can be obtained from the General Secretary, Mr. A. Brammer, and competitors should send in their entries not later than June 30th.

Appointments Vacant

Assistant master (mathematics and electrical engineering) for Paddington Technical Institute.

Temporary assistant to the consumer's engineer for Winchester Electricity Department.

(See our advertisement pages to-day.)

Educational

REGENT STREET POLYTECHNIC, 307-311, Regent Street, W.1.—A course of six lectures on thermionic valves will be given by Mr. W. H. Date on Wednesday evenings commencing May 13th. Particulars on application to the Director of Education.

(See our advertisement pages to-day.)

Utilisation of Waste Gas in Canada

A message from Winnipeg says that ambitious plans to use waste gas in the Alberta oilfields have been announced by Mr. R. Crowe-Swords, of the Hercules Consolidated Mining and Smelting Company of London, England. Conditional upon receipt from the Alberta Government of a 99-year franchise, the Hercules Company—backed by prominent British and European industrialists—would concentrate waste gas in the Turner Valley fields into one pipeline and use the pressure of the gas to turn specially designed turbine wheels for the generation of electricity. Initial expenditure would amount to $10,000,000 and construction would start in 90 days. The entire southern part of Alberta would be industrialised through subsidiary companies. It was estimated that power could be produced at a cost of about three-tenths of a cent per kWh. Waste gas in the Turner Valley fields was recently computed at 400,000,000 to 450,000,000 cu. ft. a day.—*Reuter's Trade Service* (Winnipeg).

Safety in Mines Conference

Mr. E. Shinwell, M.P., Secretary for Mines, announces that a general conference on safety in mines, representative of all those engaged in the mining industry in the Cardiff and Forest of Dean Mines Inspection Division, will be held under his chairmanship at the Assembly Hall of the City Hall, Cardiff, at 11 a.m. on May 16th. Addresses will be given by Sir Henry Walker, C.B.E., LL.D., H.M. chief inspector of mines, on "Ways and means for increasing safety in mines"; Captain J. M. Carey, O.B.E., H.M. divisional inspector of mines, on "Accidents that should not have occurred"; Professor R. V. Wheeler, D.Sc., director of the research stations under the Safety in Mines Research Board, on "Explosions"; and Major H. M. Hudspeth, D.S.O., M.C., M.Sc., mining engineer to the Board, on "Falls of ground." The addresses will be followed by questions and discussions confined to matters affecting safety. Admission will be by ticket only up to 10.50 a.m.

Fatality

An inquest was held at Banbury on April 21st on Joseph Dugdale, an employé of Messrs. Johnson & Phillips, Ltd., who received fatal injuries while at work on the erection of a h.p. line in the Eydon district. Evidence was given that deceased ascended a transmission line pole against instructions, and coming into contact with a line received a shock at 11,000 V. He was removed to Horton General Hospital, Banbury, but died soon after admission. A formal verdict was returned.

Annual General Meeting of the E.T.B.I.

The annual general meeting of the Electrical Trades Benevolent Institution was held at the Institution of Electrical Engineers, London, on April 22nd. The chair was taken by Mr. C. C. Paterson, president, I.E.E. The report of the committee and the accounts and balance sheet for the year ending December 31st, 1930, as submitted, were adopted. They showed that the income from contributions for the year was £3,889 2s. 3d., making with the receipts from dividends a total income of £5,846 14s. 8d. After payment of all outgoings a sum of £1,532 18s. has been invested, bringing the total of the invested funds up to £45,777 18s. 4d. at cost. Each succeeding year demonstrates more and more strongly the necessity of this Institution; during the year under review the number of grants made was nearly 400, amounting to £2,751 5s. 9d. The number and amount of grants have shown a very big increase since 1926, when they numbered only 75, totalling £1,105.

The annual festival held last November presided over by Mr. R. A. Chattock, resulted in the collection of over £3,600. The Propaganda Department has now begun operations, and some 25,000 copies of a booklet entitled "The Wheel of Fortune" have already been sent out. Attention is drawn to the new class of associates, to which the subscription is 5s. per annum.

The chairman expressed satisfaction that, in spite of the almost general depression, the Institution had been able to meet outgoings without having to fall back on its invested funds, and also that it was working in co-operation with the Institution of Electrical Engineers Benevolent Fund so as to avoid overlapping. After a minute had been recorded expressing the loss which was felt by the death of Mr. F. H. Nalder, members of the Council were elected as follows:—Messrs. R. W. Hughman, E. F. Johnson, E. E. Sharp, J. M. Sim, J. N. Stephens, Miss Caroline Haslett, C.B.E., and Mr. A. S. Markes. Messrs. Price, Waterhouse & Co. were re-elected honorary auditors. The thanks of the Institution were given to them, and also to Messrs. Sugden & Hextall, the honorary solicitors, to the I.E.E. for the use of its building, to the electrical Press, and to the chairman. The recommendation of the Council that the Institution should become incorporated under the Companies Act was approved.

Accident Prevention in Factories

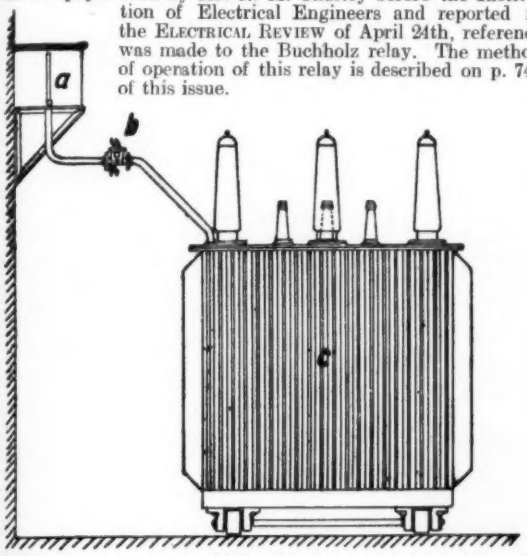
The National "Safety First" Association, of 119, Victoria Street, London, S.W.1, is again organising a special "Safety Week," which will be held this year between May 11th and 16th. A number of interesting pamphlets have been prepared by the Association and we have just received one entitled "How to Organise Successful 'Safety First' Campaign." This is the third of the series and costs twopence. It deals in particular with safety in factories and workshops and gives valuable hints on all matters relating to the formation of a new "safety first" organisation. The successful organisation of an industrial "safety first" movement is not a thing that can be undertaken lightly and all contemplating the introduction of such a movement in their factories or workshops would do well to procure a copy of this little pamphlet.

Tests on Coated Contacts

Referring to the note under the above heading in our issue of April 17th, p. 678, containing extracts from a report of the General Electric Co., Ltd., on a test on "Fescol"-ised contactors, we are asked to state that the report also mentions that two arrangements with "Fescol" contacts has at least as good a rupturing capacity as the all-copper scheme. This should be considered with the statement at the end of the note to the effect that the arrangement of copper positive to "Fescol"-ised negative was much inferior to copper in rupturing ability.

Recent Progress in Large Transformers

In the paper read by Mr. R. M. Charley before the Institution of Electrical Engineers and reported in the ELECTRICAL REVIEW of April 24th, reference was made to the Buchholz relay. The method of operation of this relay is described on p. 746 of this issue.



The accompanying figure illustrates the method of installation of this device. The relay (*b*) is connected between the oil conservator (*a*) and the transformer (*c*).

Motor-boat Conference

We are advised by the Ostend Chamber of Commerce that the exhibition in connection with the motor-boat conference will be held from May 3rd to 17th at Ostend. M. Auguste Borgers will be president.

Illumination Intensities

The selection of the correct illumination intensity is a matter of the greatest importance in the design of a lighting installation. The values given in the table following are considered good practice for industrial interiors both in Great Britain and in America; the custom in the latter country is to favour higher values than are general here.

	Foot candles.		Foot candles.
Assembly:		*Plating*	6
Rough work	8	*Polishing*	10
Medium work	10	*Power plant:*	
Fine work	20	Boilers, ash plant ...	5
Electrical Manufacturing:		Auxiliary equipment, transformers	8
Armature and coil winding; insulating processes	15	Switchboards, generators	8
Foundry:		*Sheet metal work:*	
Charging floor	5	Bench work	10
Rough moulding ...	8	Punches, shear presses, &c.	12
Garage:		*Smith shop:*	
Storage	5	Rough forgings	5
Repairs department ...	12	Fine forgings and welding	10
Inspection:		*Store room:*	
Rough	8	Rough	3
Medium	10	Medium	6
Fine	15	*Testing:*	
Machine shop:		Rough	8
Rough bench and machines	8	Fine	12
Medium bench and machines	10	Instruments	30
Fine bench and machines	15	*Warehouse*	3
Paint shop:		*Wood working:*	
Dipping, spraying ...	8	Rough bench work ...	6
Ordinary hand painting	10	Medium bench work ...	10
Fine hand painting ...	15	Fine bench work ...	12

H. E. HUTTER.

The Manchester Steam Users' Association

This Association has issued a well-produced and interesting illustrated brochure "Boiler Service" describing the aims, history, and activities of the organisation, which is composed of, and acts solely on behalf of, its members. The income, derived from members subscriptions, is devoted entirely to promoting members interests. The Association, the primary object of which is to prevent boiler explosions, is managed by an executive committee elected annually from among the members. The Association is claimed to be the oldest organisation of its kind in this country, and for over three-quarters of a century its name has been a household word in many industrial circles. Many people, however, regard it merely as an insurance company, but it is pointed out that although financial cover is issued upon boilers and engines (which is the equivalent of an insurance), that is by no means the full extent of the organisation's activities, which may be described as the protection and fostering of the interests of boiler users in the broadest sense.

A Large German Transformer

The Siemens-Schuckert Works Co. of Berlin has lately received from the Rheinisch-Westfalische Elektrizitätswerke Gesellschaft of Essen an order for a 100,000-kVA three-phase oil transformer (220/110/63.5 kV) as well as a regulating transformer for the main set with an on-load top-changing switch mounted thereon for a throughput capacity of 100,000 kVA at 110 kV ± 10 per cent. The transformer is intended for the extension of the pumped storage hydro-electric power station at Herdecke a.d. Ruhr and will be accommodated in one tank. It will be cooled by compressed-air circulation plant equipped with two oil-circulating pumps and four cooler sections with Siemens-Betz propeller fans. The regulating transformer is to be provided with cooling fins against which a blast of air will be forced from below by fans. Up to a throughput capacity of 55,000 kVA the regulating transformer will be self-cooled, the fans being switched on automatically independently of the current through the transformer.

Electric Furnaces in Russia

The Soviet Government has lately had completed by the Siemens & Halske Co. of Berlin a number of electric arc furnaces for the State smelting works at Tscheljabinsk. The plant comprises three 7,800-kVA ferro-silicon furnaces, two of 130-kVA capacity for ferro-chromium, and one of 1,300 kVA for ferro-tungsten, all being of the circular type. The ferro-silicon furnaces are stationary installations, while the others are each built with tipping mechanism to facilitate the removal of dross and the discharge of the furnaces. The ferro-silicon and ferro-chromium furnaces are fitted with continuously-burning carbon electrodes, 900 mm. in diameter in the ferro-silicon furnaces and 400 mm. in diameter in the ferro-chromium furnace. To obtain a satisfactory power factor, the electrodes in all furnaces are arranged in the form of a triangle. The furnaces are connected to three-phase 11,000-V, 50-cycle circuits fed directly by three turbo-generators. The bus-bars at the smelting works are connected to those at the power station by cables, the distance between the two systems being about 340 yards.

Generation Standing Charges

An analysis of steam generation costs into their standing and running components is made in the *Electrical World*. Fuel accounted for 75 per cent. of the operating costs in the cases investigated.

	Per cent. Standing.	Per cent. Running.
Fuel	15	85
Operating labour	98	2
Maintenance	59	41
Supplies and miscellaneous expenses	87	13
Total production expense	38	67

B.S.S. for Test Sieves

The British Engineering Standards Association have just issued a British Standard Specification for Test Sieves, No. 410-1931. The committee, in preparing this specification, has had before it the standard sieves of the Institution of Mining and Metallurgy, together with the standard sieves series of the U.S.A. Bureau of Standards, particulars of which are given in an appendix. It has been considered advisable to divide the British standard sieves into three series: fine-mesh sieves made of woven wire cloth with a size of aperture ranging from .0021 in. (300 mesh) to .1320 in. (5 mesh); medium-mesh sieves made from woven wire cloth with a size of aperture ranging from 1/32 to ½ in.; and coarse-mesh sieves made from perforated metal plate with a size of aperture ranging from ½ in. to 2 in. In order to simplify manufacture and thus reduce the cost of production, the committee has considered it necessary to adopt mesh numbers commonly used, and to specify sizes of wire included in the S.W.G. series, or intermediate sizes which are in common use. The size of the apertures being the most important feature of the cloth, special care should be taken that it deviates to a minimum degree from the nominal dimensions specified. The figures for tolerance on occasional large apertures are very wide, but it has been found impracticable, in the absence of any reliable data on the subject, to specify closer limits at the present time. The many uses to which test sieves are put are so varied that the Committee has been unable to specify the material from which they are to be made. For ordinary purposes, though, it is recommended that steel should be used for sizes coarser than 40 mesh, and phosphor-bronze for the finer meshes.

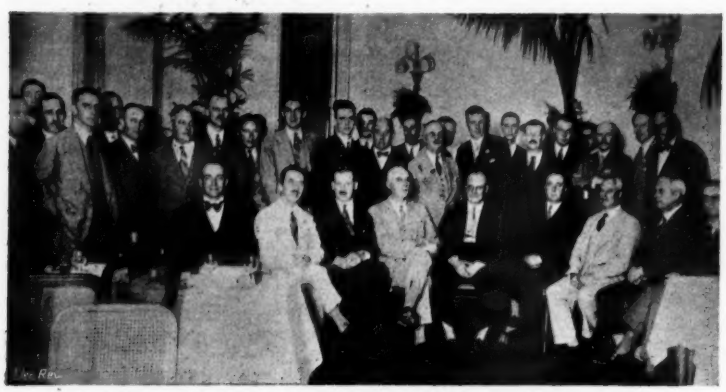
Copies of the new specification can be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. E. A. Mills, who, as reported in our last issue, has been appointed borough electrical engineer of Halifax, has had long experience in the electricity supply industry. He was educated at Liverpool College and received his technical training at Liverpool University. After serving as assistant engineer with the Yorkshire Electric Power Co. for four years, he acted as engineering assistant for two years with the undertaking of the North Metropolitan Electric Power Supply Co. Then, after a year in the Leeds Electricity Department as chief engineering assistant, and five years as assistant constructional engineer in the Birmingham Electric Supply Department, he went to Shanghai as superintendent electrical engineer in the Municipal supply undertaking, later becoming executive engineer of power stations. He returned home after seven years in Shanghai and for the last three years has been deputy engineer and manager of the Leicester Electricity Department. He was recently one of the last two selected candidates for the Croydon appointment. Mr. Mills is a member of the Institutions of Electrical and Mechanical Engineers and an associate member of the Institution of Civil Engineers.

In our last issue we mentioned a luncheon given by **Mr. V. Watlington,** chairman of the B.E.A.M.A. Council, and **Mr. H. C. Siddeley,** special B.E.A.M.A. representative, to members of the Argentine Local Centre of the Institution of Electrical Engineers, at the British Empire Trade Exhibition, Buenos Aires. We have now received from our Buenos Aires correspondent a photograph of a group taken at this function and



Messrs. Watlington and Siddeley with Members of the I.E.E. Local Centre at Buenos Aires

reproduce it herewith. In the front are Mr. A. Lovill (A. Reyrolle & Co., Ltd.); Mr. R. G. Parratt (past-president of the Argentine Local Centre); Mr. J. Wilson (past-president); Mr. H. C. Siddeley; Mr. R. Wright (president of the Local Centre); Mr. V. Watlington; Mr. A. C. Kelly (hon. secretary of the Centre); and Mr. F. Harris (vice-president).

Sir Philip Dawson, M.P., who contributes to this issue some views on the Weir Committee's report on main-line electrification, is a leading figure in the electric traction world. His first article on the subject, dealing with electric tramways, appeared in the ELECTRICAL REVIEW nearly 40 years ago and soon afterwards he was able to assist in putting his principles into practice at Bristol. Sir Philip was responsible for the successful electrification of a section of the London, Brighton and South Coast Railway, the extension of which was somewhat delayed by the grouping of the railways. Before the war he prepared a scheme for the electrification of the Glasgow suburban services of the Caledonian Railway, and at later dates drew up schemes for the conversion of the Liverpool Street lines of the Great Eastern Railway and the Taunton to Penzance section of the Great Western Railway. Two years ago he was called in by the Egyptian Government to advise it on the electrification of suburban lines. His work has received recognition from a number of societies.

Mr. C. Honour, assistant mains superintendent at Carlisle, has been appointed mains superintendent in the Taunton Corporation Electricity Department.

Mr. H. V. Pointon, the manager for India of Asea Electric, Ltd., is due in this country for a short holiday about the middle of May. Mr. Pointon will remain in England until about the end of October and his address will be c/o Asea Electric, Ltd., 5, Chancery Lane, W.C.2.

Mr. J. C. Breakey has been appointed manager of the Holywood (Co. Down) electricity undertaking in succession to Mr. N. Pryce Jones, who recently received a Central Electricity Board appointment. After serving his apprenticeship with Messrs. Hugh J. Scott (Belfast), Ltd., Mr. Breakey became engineer and manager of the electrical department of a Dublin company.

Mr. R. W. Dalton, His Majesty's Trade Commissioner for Australia, whose report was summarised in our last issue, left Sydney early in March for London. He is visiting this country on furlough and expects to be away from Australia for twelve months. He will be performing official duties here during part of his stay. The *Industrial Australian* for March 12th devotes its leading article to an urgent appeal to the British Government to appoint Mr. Dalton as a British High Commissioner for Australia, because of his sound working knowledge of the country and its "peculiarities," and because he has filled with distinction many Empire posts under the Board of Trade.

It is officially announced by the Department of Overseas Trade that Mr. Dalton will be available in London for interviews with British exporters between May 18th and 30th; later he will visit the provinces. Communications regarding appointments to meet him should be addressed to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Reference 1,452/1931).

Mr. A. J. Hutchinson, chief electrical engineer and general manager to the Farnworth electricity undertaking, was presented with a sports watch by the members of the Electricity Bulk Supply Engineers' Association of Lancashire and Cheshire last week as a tribute to his services since his inauguration of the Association. Mr. H. W. Angus, electrical engineer to Eccles Corporation, made the presentation on behalf of the members.

Mr. H. Binns, who has been acting manager of the Keighley Corporation tramways for the past six months, has been appointed (subject to the Council's approval) general manager, at a salary of £400 per annum.

We regret to hear that **Mr. A. T. Bartlett,** chief of the Development Laboratory at the Witton Engineering Works of the G.E.C., sustained head injuries in a motor collision in Berlin last week, necessitating his removal to hospital.

Preston Electricity Committee recommends that the appointment of **Mr. J. A. Robertson** as consulting engineer at a fee of £400 per annum be renewed for one year.

Mr. T. Mensforth, B.Sc., A.M.I.E.E., the elder son of Sir Holberry Mensforth, chairman of the English Electric Co., Ltd., has been appointed chief engineer to Dorman, Long and Co., Ltd. He had been electrical engineer to the company for nearly a year.

Mr. A. E. Hadley, the managing director of the Victoria Falls and Transvaal Power Co., Ltd., has been elected to the board of the British South Africa Co.

Obituary.

Major H. M. Leaf.—We regret to report that Major Henry M. Leaf, D.S.O., was accidentally killed on April 23rd when he was knocked down by a motor omnibus in London. Major Leaf, who was born in 1862, was perhaps best known through his connection with the London Electrical Engineers. He served as captain in that corps during the last South African War. During the early part of the Great War he held a commission in the R.N.D. and was awarded the D.S.O. Later he was transferred to the R.M.A.; he was promoted major, was wounded, and was mentioned in dispatches. Major Leaf was educated at Marlborough and Trinity College, Cambridge, and University College, London. He was a pupil at the Chelmsford works of Crompton & Co., and later superintended the installation of electrical plant at Gothenburg and Le Mans and in a number of towns and buildings in this country. Writing to *The Times* last week, Col. R. E. Crompton recalled this association and Major Leaf's work with him in South Africa and expressed regret at his untimely death.

We have received the following tribute from a friend:—"Major Leaf was a man of lovable character. To a strong sense of duty and a natural probity characteristic of his family, were added a lion's courage, a loyalty to his friends, and an infectious enthusiasm in work and play which was irresistible. In his private life and his professional career he was incapable of anything mean or petty and in matters of business his word was his bond."

Mr. F. Peacock.—The death occurred suddenly on April 13th, at the age of 68 years, of Mr. Frederick Peacock, electrical contractor, Colchester, where he had been in business since 1900. Previously he was outside representative of Messrs. Laurence, Scott & Co.

Mr. F. Oram.—The death occurred on April 22nd of Mr. Frank Oram, resident engineer of the Rushden Electric Supply Co., Ltd. He was connecting wires to a standard at Harrold, Beds., when he received a shock and fell from the top of the standard to the pavement below.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered

Houchin, Ltd.—Private company. Registered April 22nd. Capital, £500 in £1 shares. Objects: To carry on the business of the Eastern Armature Winding Co., electrical and mechanical engineers and contractors, &c. The directors are: R. Houchin, electrical engineer, and Mrs. Kate Houchin, 33, Broadwalk, Woodford. Registered offices: 73a, Garford Street, E.14.

British Wireless Exchange, Ltd.—Private company. Registered April 23rd. Capital, £2,000 in £1 shares (1,500 "A" and 500 "B"). Objects: To carry on the business of a wireless exchange in all its branches. The directors are: W. E. Kaine, 13, Boleyn Road, East Ham, E.6; C. H. Evans, "Bryngwyn," 14, Burford Gardens, Palmers Green, N.13; R. G. Tallack, 4, Wellington Road, N.W.8. Registered office: 90, Cannon Street, E.C.4.

Parade Radio and Electrical Stores, Ltd.—Private company. Registered April 23rd. Capital, £200 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in telephone, telegraph and radio instruments, electrical engineers, &c. The directors are: H. C. M. Watkins, 115, Sandford Road, Moseley, Birmingham; H. W. L. Tolley, 58, Redthorne Grove, Stechford, Birmingham. Registered office: 60, Parade, Birmingham.

Downton Electric Light Co., Ltd.—Public company. Registered April 22nd. Capital, £17,500 in £1 shares. Objects: To adopt an agreement between the Southern Tanning Co. (1920), Ltd., and A. J. R. Lobbett; and to carry on the business of electric lighting and power, &c. The subscribers are: J. A. V. Mitchell, 11, Springfield Grove, Bristol; W. P. Price, 18, East Shrubbery, Redland, Bristol, and five others. Secretary: F. H. Campkin. Registered office: 11, Waterloo Street, Birmingham.

Electric and Gas Industries, Ltd.—Private company. Registered April 21st. Capital, £1,000 in £1 shares. Objects: To acquire any undertaking or business in Great Britain or elsewhere for the generation, manufacture, distribution, supply, accumulation or employment of electricity or gas for light, heat, power, &c., and to carry on the business of an electric and power and gasworks company in all its branches. The subscribers are: R. R. J. Turner, 115, Leadenhall Street, E.C.3; N. L. Kelly, Dyers Hall, Chignal Smeeley, Chelmsford, solicitors. Registered office: 115, Leadenhall Street, E.C.3.

British Carbons, Ltd.—Private company. Registered April 24th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of, and dealers in, machinery and apparatus of all kinds for generating electricity, dynamos, motors, batteries, &c. The permanent directors are: H. Sampson, Ashmount, Lidget Hill, Bradford, engineer; A. Southern, 26, Hastings Terrace, Marshfields, Bradford, electrical engineer; B. Holbrey, 38, Horton Green, Bradford, engineer.

Dryfields, Ltd.—Private company. Registered April 15th. Capital, £5,000. Objects: To carry on the business of electrical engineers, dealers in electrical materials and appliances, &c. The subscribers are: A. Dixon, 2, Crow Wood Park, Halifax; J. G. Hill, 3, Chapel Street, Bloomsbury, W.C.1. Secretary: G. H. Glover. Registered office: 65a, Oxford Street, W.1.

H. H. Hartfree, Ltd.—Private company. Registered April 20th. Capital, £2,000 in 1,000 5 per cent. preference and 1,000 ordinary shares of £1. Objects: To acquire the undertaking and all the assets and liabilities of Horace H. Hartfree, and to carry on the business of wholesale manufacturers of, agents for, and dealers in, all electrical goods, electrical installations for lighting, heating and power work, dynamos and motors, &c. The directors are: H. H. Hartfree (managing director), 155, Kingston Road, New Malden; L. P. Hartfree, 37, Kingston Road, New Malden. Secretary: C. J. Birch. Registered office: 155, Kingston Road, New Malden, Surrey.

S. Kershaw France & Co., Ltd.—Private company. Registered April 18th. Capital, £800 in £1 shares. Objects: To acquire the business of electrical manufacturers and contractors, &c., carried on by S. Kershaw and Co., at 2, Hornspit Lane, West Derby, Liverpool. The subscribers are: S. Kershaw, 2, Hornspit Lane, West Derby, Liverpool, electrician; T. E. France, 93, Lodge Lane, Liverpool, radio engineer. T. E. France signs documents as director. Registered office: 2, Hornspit Lane, West Derby, Liverpool.

Scientific Sound Systems, Ltd.—Private company. Registered April 20th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers and producers of, and dealers in, machinery, apparatus and appliances for recording and transmitting sound pictures and the like, electrical engineers, &c. The life directors are: E. Paroussi, 19, Kelvin Road, N.5 (chairman); W. M. Bette, 8, Colson Road, East Croydon; B. W. Parry, "Woodlands," 109, Clarendon Gardens, North Wembley. Secretary: Winifred I. Paul. Registered office: 10, Featherstone Buildings, Chancery Lane, W.C.2.

Official Returns of Electrical Companies

Hightensite (1930), Ltd.—Satisfaction to the extent of £1,000 on April 7th, 1931, of debentures authorised by resolution dated October 17th, 1930, and registered October 17th, 1930. (According to the register of mortgages, the debentures registered October 17th, 1930, originally secured £10,000).

F. J. Ashton, Ltd.—Debenture dated April 13th, 1931, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. J. Heller, 173, Highbury New Park, N.5.

Allen West & Co., Ltd.—Debenture dated April 8th, 1931, to secure £100,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Bishopsgate Nominees, Ltd., 15, Bishopsgate, E.C.

Kye Electrical, Ltd.—Capital, £25,000 in 20,000 cumulative participating preference shares of £1 and 100,000 ordinary shares of 1s. each. Return dated December 30th, 1930. 12,502 preference and 92,500 ordinary shares taken up. £17,127 paid. Mortgages and charges, nil.

Brookhirst Switchgear, Ltd.—Capital, £550,000 in 100,000 redeemable preference and 450,000 ordinary shares of £1 each. Return dated January 5th, 1931. 126,002 ordinary shares taken up. £30,502 paid. £95,500 considered as paid. Mortgages and charges, £25,000.

Helco Dynamo Co., Ltd.—Capital, £20,000 in 8,000 "A" and 12,000 "B" shares of £1 each. Return dated December 23rd, 1930. 8,000 "A" and 5,062 "B" shares taken up. £3,062 paid on 3,062 "B" shares. £10,000 considered as paid on 8,000 "A" and 2,000 "B" shares. Mortgages and charges, nil.

Surrey Wholesale Electrical Co., Ltd.—Capital, £1,000 in 500 "A" shares of £1 and 10,000 "B" shares of 1s. Return dated December 24th, 1930. 451 "A" and 8,600 "B" shares taken up. £275 paid on 101 "A" and 3,600 "B" shares. £6 calls unpaid. £600 considered as paid on 350 "A" and 5,000 "B." Mortgages and charges, nil.

Woodstock Power Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated January 13th, 1931. 3,510 shares taken up. £3,510 paid. Mortgages and charges, £2,300.

Siemens Schuckert (Great Britain), Ltd.—Capital, £10,000 in £1 shares. Return dated January 5th, 1931. 9,400 shares taken up. £9,400 paid. Mortgages and charges, nil.

Bective Electrical Co., Ltd.—Capital, £10,000 in 116 6 per cent. preference and 80 7 per cent. preference shares of £50 each and 4,000 ordinary shares of 1s. each. Return dated December 30th, 1930. 114 6 per cent. preference, 64 7 per cent. preference, and 4,000 ordinary shares taken up. £9,100 paid Mortgages and charges, nil.

Maybrook Electrical Co., Ltd.—Capital, £5,000 in 1,000 preference and 4,000 ordinary shares of £1. Return dated January 13th, 1931. 100 preference and 2,000 ordinary shares taken up. £2,100 paid. Mortgages and charges, £3,000.

George Hall & Co., Ltd.—Capital, £4,000 in £1 shares. Return dated October 28th, 1930. 2,150 shares taken up. £2,150 considered as paid. Mortgages and charges, nil.

Pickvance, Ltd.—J. Unwin, Prudential Buildings, Foregate Street, Chester, was appointed receiver and manager on April 14th, 1931, under powers contained in debentures dated July 10th, October 11th, and December 5th, 1924.

Hendon Electric Lamp Co., Ltd.—H. Bell, 27, Pont Street, S.W.1, ceased to act as receiver and manager on April 15th, 1931.

New Phonopore Telephone Co., Ltd.—Capital, £10,000 in 9,000 ordinary and 1,000 founders' shares of £1. Return dated December 31st, 1930. 7,141 ordinary and 1,000 founders' shares taken up. £6,741 paid on 6,741 ordinary shares. £1,400 considered as paid on 1,000 founders' and 400 ordinary shares. Mortgages and charges, £2,666 13s. 4d.

Bullers, Ltd.—Capital, £400,000 in 20,000 preference and 20,000 ordinary shares of £10 each. Return dated January 12th, 1931. 15,000 preference and 15,593 ordinary shares taken up. £150,070 paid on 15,000 preference and 7 ordinary shares. £155,860 considered as paid on 15,586 ordinary shares. Mortgages and charges, £189,200.

Kamm & Co., Ltd.—Land registration charge, on 27, Powell Street, Finsbury, E.C.1, dated March 31st, 1931, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

B. G. Suthers, Ltd.—Debenture dated April 11th, 1931, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Electrical Installations, Ltd., 27, Martin Lane, E.C.4.

Perak River Hydro-Electric Power Co., Ltd.—Capital, £1,000,000 in 500,000 8 per cent. preference and 500,000 ordinary shares of £1. Return dated February 5th, 1931. 500,000 preference and 431,237 ordinary shares taken up. £576,507 paid on 500,000 preference and 76,507 ordinary shares. £354,730 considered as paid on 354,730 ordinary shares. Mortgages and charges at February 5th, 1931, £3,450,000. Since registered, £200,000 5½ per cent. prior lien debenture stock (part of a series of £400,000 authorised February 25th, 1931).

Steatite and Porcelain Products, Ltd.—Debenture dated April 2nd, 1931, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd., charged on the company's undertaking and property, present and future, including uncalled capital and goodwill (subject as to company's 30 houses and land at Stourport to mortgage dated July 3rd, 1929).

Kartret Switchgear Co., Ltd.—Capital, £2,500 in £1 shares. Return dated January 1st, 1931. All shares taken up. £2,500 considered as paid. Mortgages and charges, nil.

Shirebrook Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated January 5th, 1931. 4,800 shares taken up. £3,700 paid (being £1 per share on 2,800 and 10s. per shares on 2,000 shares). £100 calls unpaid. Mortgages and charges, nil.

Flinders (Wholesale), Ltd.—Capital, £7,000 in 3,000 preference and 4,000 ordinary shares of £1 each. Return dated January 12th, 1931. 3,000 preference and 3,000 ordinary shares taken up. £6,000 paid. Mortgages and charges, nil.

Thalberg, Halstead, Ltd.—Capital, £1,000 in £1 shares. Return dated January 12th, 1931. All shares taken up. £630 paid. £370 considered as paid. Mortgages and charges, nil.

Hazeltine Neutrodyne Radio Sets, Ltd.—Capital, £5,000 in £1 shares. Return dated January 5th, 1931. 4,900 shares taken up. £1 per share called up on 2,550 shares and nil on 2,350 shares. £2,550 calls unpaid. Mortgages and charges, nil.

Darimont Electric Batteries, Ltd.—Capital, £18,000 in 62,000 ordinary shares of 5s. and 50,000 deferred shares of 1s. each. Return dated December 29th, 1930. All shares taken up. £8,999 16s. paid on 34,666 ordinary and 6,666 deferred shares. £9,000 4s. considered as paid on 27,334 ordinary and 43,334 deferred shares. Mortgages and charges, nil.

Grierson, Ltd.—Capital, £10,000 in 4,000 preference and 6,000 ordinary shares of £1 each. Return dated November 11th, 1930. 4,001 ordinary shares taken up. £4,001 paid. Mortgages and charges, nil.

Electric and Gas Industries, Ltd.—Particulars filed of £2,000,000 debentures authorised April 22nd, 1931, charged as a floating security on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £100,000.

City Notes

Associated Electrical Industries, Ltd.

The accounts for the year ended December 31st last, which were submitted to the annual meeting held yesterday at Bush House, London, show that after deducting all expenses, other than debenture interest and depreciation, there was a profit of £372,998, as compared with £365,961 for 1929. To this £109,241 brought forward is added, making £482,239. Debenture interest absorbs £41,452 and depreciation £66,226, and £25,000 (against £15,273) is transferred to reserve. The ordinary dividend is maintained at 6 per cent. and a balance of £110,411 goes forward to the next account. The trading results include dividends declared by the subsidiary companies. The report says that all the works of the group were reasonably well filled during 1930 and the output compared favourably with that of the previous year. The resignation of Lord Wargrave from the board is recorded and it is mentioned that Mr. C. H. Minor and Col. T. W. Pragnell were appointed directors during the year. The annual meeting was to be held yesterday (Thursday).

With the report the company distributed to shareholders an illustrated folder describing some of the work of the company and its subsidiaries during 1930. The chief works are situated in Birmingham, Brimsdown, Coventry, Lydbrook, Manchester, Ponders End, Rugby, Sheffield, and Willesden, and they give employment to about 31,000 persons.

The following is a list of the associated and allied companies: The British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd., Edison Swan Cables, Ltd.; Ferguson, Pailin, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Metropolitan-Vickers Electrical Export Co., Ltd.; Associated Electrical Industries (India), Ltd.; Australian Electrical Manufacturing Co., Ltd.; Cosmos Lamp Works, Ltd.; General Railway Signal Co., Ltd.; Harcourts, Ltd.; Hotpoint Electric Appliance Co., Ltd.; and Park Royal Engineering Co., Ltd.

The accounts include a consolidated balance sheet of the group as at December, 1930, incorporating the assets and liabilities of A.E.I., Ltd., and of its subsidiary companies; it discloses the financial position of the group of companies if regarded as a single undertaking. In view of the magnitude of the concern and its far-reaching operations we give the main items on both sides of the accounts in tabular form below:—

DR.	
To *Capital* Authorised: £5,161,950 ordinary and £1,233,050 eight per cent. cum. pref. shares, all of £1 each ... ... =	£6,395,000
Capital Issued: Ordinary £3,498,900; Preference £1,233,050	£4,731,950
Debenture stock (4 per cent. mortgage) ...	£1,036,353
Creditors, loans, accrued charges, and reserves for contingencies	£1,843,586
Amounts owing to subsidiary companies ...	£78,044
General Reserve (balance as per last balance sheet, £800,000; transferred from profit and loss account, £25,000)	£825,000
CR.	
By *Subsidiary Companies*:—Shareholdings in British Thomson-Houston Co., Ltd., 2,000,000 Ordinary of £1 each, fully paid; Edison Swan Electric Co., Ltd., 892,998 Ordinary of 4s. each, fully paid, 8,009 7½ per cent. Cum. Pref. of £1 each, fully paid; Ferguson, Pailin, Ltd., 59,950 7 per cent. Cum. Part. Pref. of £1 each, fully paid, and 89,750 Ordinary of £1 each, fully paid. At cost	£2,090,922
Other subsidiary companies at cost *less* amounts written off	£174,045
Amounts owing by subsidiary companies ...	£1,373,868
Total	£3,638,834
By *Trafford Park, Sheffield, and other Assets*—	
Works, machinery, plant, tools, patterns, and furniture, at Trafford Park, Sheffield, and various offices	£1,489,064
Patents and goodwill	£75,000
Stock and materials on hand, work and contracts in progress	£1,611,546
Debtors, loans, payments in advance (including amounts due on completed work on contracts), *less* Reserves	£1,748,216
Sundry investments: British and Dominion Government Securities, £53,613; miscellaneous, £58,238	£111,851
Cash at bankers and in hand	£172,483

Bournemouth & Poole Electricity Supply Co., Ltd.

The accounts of this company were abstracted in our issue of April 17th (p. 682), and the annual meeting was held on April 22nd. Mr. R. B. Renwick (vice-chairman), who presided, expressed regret at the absence of Sir Harry Renwick (chairman), and read the chairman's speech, in the course of which he said the sales of electricity during the year had increased by nearly 17 per cent. In new business there was an increase of 5,128 kW, and 2,771 additional consumers had been connected. The power station was enlarged by the installation of a further 5,000-kW set, and they had increased the mileage of mains by 74. During the past five years the company had provided over £345,000 in additional capital expenditure on plant, mains, &c., and during the same period they had almost doubled their output, while revenue had only increased by 25 per cent. due to reductions made in the charges for electricity. Regarding the South-West England electricity scheme, their request that the Central Electricity Board should defray the cost of standardising their system had not met with success, and they had requested that the matter should go to arbitration. The lighting flat rate was reduced as from the June quarter last year, and if a reasonable settlement was arranged with the local authorities for an extension of tenure, consumers could look forward to substantial benefits. Their two-part tariffs were very popular, over 35 per cent. of their total output for lighting and heating being sold under this system. A supply of electricity was inaugurated in the Wimborne district in September last, and an Order was awaiting confirmation by Parliament, authorising them to supply in an extended area in Dorset. With this added area the company would have powers to supply electricity over about 325 sq. miles in Hampshire and Dorset. Negotiations for an extension of tenure had continued throughout the year, and the local authorities' decision was expected at an early date. The report and accounts were adopted.

Johnson & Phillips, Ltd.

The report for the year ended December 31st, 1930, shows that the trading profit, after allowing for bad debts and charging upwards of £14,000 to revenue for maintenance, was £128,334, as compared with £158,191 for 1929. The net profit, after meeting debenture interest, depreciation, &c., is £78,806 (against £102,514). A balance of £123,417 is added and from the total it is proposed to transfer £25,000 to a research and development account and £15,000 to dividend equalisation account. A final dividend of 5 per cent., again making 10 per cent. for the year, is recommended on the ordinary shares and a balance of £102,223 will be carried forward. In view of the general trade depression, particularly during the last few months of 1930, the directors consider the results of the year's trading satisfactory. The report records the death of Mr.

John Macgregor, chairman and managing director. Mr. G. Leslie Wates is now chairman and Mr. H. J. Sheppard, the secretary, is managing director. Meeting: May 4th.

Cables & Wireless, Ltd.

It is announced that the offer which has been made to holders of ordinary stock in the Eastern Telegraph Co., the Eastern Extension, Australasia and China Telegraph Co., and the Western Telegraph Co., and to holders of 7 per cent. cumulative participating preference shares, and £1 ordinary or 10s. ordinary shares in Marconi's Wireless Telegraph Co., to exchange their holdings for appropriate amounts of fully-paid stocks of Cables & Wireless, Ltd., will not be available after June 30th next. On the same day the offer to purchase at £3 per share outstanding £1 ordinary shares and £1 preference shares in Marconi's Wireless Telegraph Co. will expire.

London Electric Wire Co. & Smiths, Ltd.

The report for 1930 shows a net profit of £58,936, as compared with £110,622 in the preceding year, to which is added £30,075 brought forward, making £89,011. It is proposed to pay a final dividend of 3¾ per cent., making 5 per cent. for the year, against 7½ per cent. in 1929. The report states that during the year the business was affected by general trade depression, and particularly by the serious fall in market prices of copper and other raw materials. The death of Sir George H. Fisher-Smith and the election of Mr. W. J. Terry as chairman are recorded.

Lanarkshire Traction Co.

The report for 1930 shows a revenue of £142,464, as against £132,698 in 1929, and a gross profit, subject to depreciation, of £6,284, as against a gross loss of £5,486. The tramway undertaking has been abandoned and a service of motor 'buses substituted. The abandonment of the tramways has involved a loss which will ultimately be reduced by the sale of certain scrap and allowances for obsolescence which are being claimed from the revenue authorities.

International Aluminium Co., Ltd.

The report for 1930 shows a profit of £62,350 (against £63,901 in 1929). After deducting debenture interest, &c., there is a net profit, subject to tax, of £42,449, to which is added £11,235 brought forward, making £53,684. It is proposed to write off "land purchased Parciau," £7,000, to transfer £12,000 to income tax reserve, and to place £7,500 to general reserve. The amount carried forward, after providing for preference dividend for the half-year to December 31st, is £13,720.

"The Underground" Group

Meetings of stockholders and shareholders are being held to-day (Friday) at which the attitude of the Group towards the London Passenger Transport Bill will be explained. It is announced that Lord Ashfield hopes to be able to state the terms upon which, subject to the approval of Parliament, the transfer of the undertaking will be effected. These terms will be put forward in sufficient detail for the meeting to reach a conclusion as to their acceptance, and if thought fit, a resolution approving them will be passed.

Madras Electric Tramways (1904), Ltd.

The gross profit for 1930 was £28,319, as against £25,879 in the previous year. After providing for debenture sinking fund, depreciation, &c., a dividend of 2½ per cent. (against nil) is proposed on the ordinary shares, leaving £6,521 to be carried forward. The report states that, although opposition by motor omnibuses was still encountered, the traffic receipts from the tramways, and the number of passengers carried, showed increases of 4.79 per cent. and 4.2 per cent., respectively, over the previous year.

French Companies

The *Compagnie de Forges et Ateliers de Constructions Electriques de Jeumont* proposes to pay a dividend of 40 fr. per share for 1930, as compared with 37.50 fr. in the previous year.

The *Compagnie Française Thomson-Houston* reports net profits of 32,038,000 fr. for 1930, as compared with 28,302,000 fr. in the previous year. The dividend is maintained at 6 per cent. on the ordinary share capital of 400 million fr. (against 300 millions in the preceding year).

Ever Ready Co. (Great Britain), Ltd.

The directors announce that subject to completion of audit, the net profit for the year ended March 31st last is £306,000, as compared with £244,000 in the previous year. A final dividend of 25 per cent. is recommended on the ordinary shares, making 35 per cent. for the year. The reserves and carry-forward total £612,000, as against £534,000.

Aluminium Corporation, Ltd.

The report for 1930 shows a profit of £12,413, and after providing for debenture interest, &c., a net loss of £5,801, to which is added £7,276 brought forward, making a total debit at profit and loss account of £13,077, which is carried forward.

Cornwall Power Co.

The report of the Parliamentary company for 1930 shows a working profit of £18,549. It is proposed to pay a dividend of 5 per cent. on the ordinary shares (against 7 per cent.). The accounts of the limited company show a total balance of £19,793. The ordinary dividend is 3 per cent. (4 per cent.), and £1,793 is carried forward.

Winnipeg Electric Co.

The gross income for 1930 was $2,431,915, and after deducting fixed charges, &c., setting aside $515,345, adding $362,059 brought in, and providing $589,889 for preferred and common stock dividends, the balance carried forward is $344,978. The report states that the gross earnings of the electric railway and gas utilities were affected by depression in trade, but the earnings of the electrical utility showed a small increase, as compared with the preceding year.

Western Union Telegraph Co.

The report for the quarter ended March 31st last shows gross revenues of $28,325,818, against $33,617,769 for the first quarter of the preceding year. Total expenses were $25,707,611 (against $30,780,457), and the net income was $1,278,877 (against $1,808,751).

Hopkinsons, Ltd.

The report for the year ended January 31st last shows that after charging depreciation, &c., and providing £10,000 for income tax, the net profit was £31,512. The dividend on the ordinary shares is reduced from 10 to 5 per cent., and the amount carried forward is £18,738 (against £19,776).

Ebonite Container Co., Ltd.

The report for 14 months ended February 28th last shows a net profit of £9,277 (against £13,908 in the previous year). It is proposed to pay a dividend of 10 per cent. (against 10 per cent., and a bonus of 2½ per cent.), to transfer £1,375 to tax reserve, and to carry forward £8,848 (£7,533).

Spanish Company

The report for 1930 of the *National Telephone Co. of Spain* shows a net profit of £1,200,000, and, with an amount brought forward, more than £1,600,000 is available for distribution. The amount carried forward is £243,000. The increasing use of telephones in the Peninsula is shown by the fact that, taking the last six years as a unit, Spain holds the world's record for telephone development. During 1930 more than 50,000 telephones were installed, while 65 per cent. of the old manual telephones were converted to the automatic system.

Swedish Company

The accounts of *A.B. Elektrolux* for 1930, show an income of kr. 10,544,634, while expenses were kr. 1,780,863, but owing to exchange losses of kr. 720,950, the net profit is lower at kr. 8,042,822 (against kr. 8,539,984). Reserve receives kr. 1,000,000, and the dividend is again 9 per cent., leaving kr. 2,208,775 to be carried forward.

Stocks and Shares

TUESDAY EVENING.

STOCK Exchange markets were favourably affected by the opening of the Budget on Monday in this week. Estimates had been so rife in advance of Mr. Snowden's speech with regard to the proposals that he was likely to lay before the country, that, upon all doubts being resolved, there was noticeable a sensation of relief at the suspense being over and uncertainty removed. It is many years since there was so much speculation as to the channels that a Chancellor of the Exchequer would explore in his search for substantial sums of money with which to balance his Budget. The speech itself led to a strengthening of the markets for gilt-edged securities. The 4½ per cent. debenture stocks of the Central Electricity Board and of the London & Home Counties Joint Electricity Authority Boards show gains of 1 and 5s., respectively.

Financial Trouble in America

The principal centre of financial trouble at the present time is New York, as the hub of American sentiment. Heavy falls have occurred in a number of stocks and shares, those of the utility companies being harshly affected with the rest. The failure of a large firm of New York Stock Exchange brokers, with international connections, served to underline the depression that already existed. There has been a lot of liquidation on account, not only of American operators, but also on the part of people on this side who are compelled to part from their holdings in order to raise money required to meet losses, to pay taxes, and to meet other outgoings. The result of the American slump has had no great influence over commercial and industrial shares which are negotiated in this country, excepting, of course, those closely connected with the United States. But the sentimental effect is far-reaching. Selling came not only from New York, but also from Paris, Amsterdam, Brussels, and other Continental centres. In the circumstances, it is at least satisfactory to observe the firm front presented by Home Electricity Supply shares.

Electricity Supply Shares

The actual changes in the list of electricity supply shares show three rises against one fall. The latter has lowered Clyde Valley shares to 1¼. Bournemouth & Poole recovered the dividend taken off the price last week. So did North Meropolitan Electric preference. Urban ordinary are 1/16 better at 28s. 9d. In the provincial list, it may be mentioned

that Northamptons are steady at 41s. 3d., and Richmonds at 43s. The new Northamptons fell back to 7s. 6d. premium: Electrical Distribution of Yorkshire new shares remain at 8s. premium. Amongst the Indian shares, Calcutta Electric new stand at 35s., which is about 1s. 9d. less that the price of the old shares. Atlas have gone back a little to 19s. 3d., while the preference are unchanged at 23s. 9d. British Power and Light shares at half-a-guinea continue dullish.

Railway Electrification and London Transport

The proposals of the Weir Committee have been received in the Stock Exchange with no little caution. Although anything which gave the home railway companies a hope of emerging from the slough of financial despond in which they are at present sunk would be welcomed, the sum mentioned is regarded as being enormous. The Southern Railway and the Underground Electric Railways of London have shown that electric transport, as applied to home railways, can be made profitable to the investor and serviceable to the traveller, but there are so many things to consider in connection with the application of the idea to the trunk lines of the country that the financial interests may well hesitate before venturing any decided opinion at a time like the present.

Prices of home railway stocks were not affected one way or the other by the publication of the Weir Committee's recommendations. Greater interest is taken in the consideration of the Government's London Passenger Transport Bill. Underground Railways shareholders are to meet on Friday in this week, when Lord Ashfield will have something definite to say as to the terms upon which the Government proposes to take over the companies. Metropolitan consolidated has gone back a point. Underground Electric Railways are 6d. better at 22s., the extra tax on petrol being regarded as of no great account. Amongst tramway issues, London United preference are better at 5s.

Dollar Stocks

Stock and shares in colonial and foreign countries have been shaken by the further slump that has occurred in America and on the European Continent. Indirect consequences are seen in a fall of 3 points in Perak River Hydro-Electric 7 per cent. debenture stock to 37¼. Mexican Light & Power common, at 42½, show a fall of 8, making 15 points within a fortnight. Brazilian Traction ordinary shares have further dropped to 19, a loss of 2½ on the week. Renewed weakness has occurred in the Anglo-Argentine Tramways group, where the 5 per cent. debenture at 30½ is 2 down, the fall being 10 points in a couple of weeks. American Telephone & Telegraph at 187½ are 7 lower, and International Telephones at 28 are down 4. Shawinigan Water at 51 has shed 2 points. Power Corporation of Canada at 55½ is 4½ down, and Montreal Light & Power shares have given way to 57½. The Spanish stocks continue heavy, Barcelona Traction first mortgage bonds being down to 40½, showing a fall of 2.

Manufacturing and Equipment

Why the shares of the best-class manufacturing and equipment companies should have fallen heavily during the past few days it is impossible to say, unless people are in want of money, and are obliged to realise what is saleable at a time when so many things have approached the point where realisation becomes a matter of difficulty. It is, of course, the case, as mentioned here on previous occasions, that what may be called the gilt-edged shares in the manufacturing group, for instance, British Insulated, Callender's, Enfield and Henley's, have been standing for some time past at prices that offer, on the basis of the present dividends, a modest return on the money. In view of the trade conditions, and the daily publication of reports from so many industrial companies that show decreasing profits, holders of shares upon which the income-rate is moderate are inclined to ask whether their own companies may not be likely to show diminished earnings in respect of the current year. Henley's have fallen 5s. to 5⅞, Callender's are also 5s. down at 51s. 3d. Smaller falls have occurred in British Insulated at 2¾, and Enfield Cables at 4½.

Relatively, the principal fall in this department is one of 4s. 3d. to 32s. 6d. in Johnson & Phillips shares. The company's net profit, after deduction of debenture interest, &c., is £23,000 down on the year at £78,000. The company declares the usual dividend of 5 per cent., making 10 per cent. for the year. Telegraph Constructions, at 13½, are again 10s. down, the fear being expressed that the company will not be able to maintain the 10 per cent. dividend paid in respect of last year, which the figures showed was not fully earned. The Ever-Ready Company increased its profits last year by £62,000, the net figure, subject to completion of audit, being £306,000. On this, the price of the shares went 9d. better at 19s. India-Rubber preference strengthened to 11s. 3d. British Aluminium ordinary, at 29s. 9d., are 6d. higher. Siemens are unchanged at 21s. 3d., and Electric Constructions hold their rise at 12s. 6d. Philips Lamps have gone back to 33s. 9d. Associated Electrical Industries preference fell to 27s. 6d., though the ordinary are steady at 21s. 6d. G.E.C. ordinary lost a few pence at 45s. The iron and steel department is heavy. Babcock & Wilcox are ½ down, on the dividend reduction, to 46s. 3d; Vickers have eased off to 7s. 1½d. The rubber share market is very depressed, in consequence of the flatness in the price of the raw material.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES

	Nom.	Approx. Dividend. 1929.	1930.	Price April 28 1931.	Rise or fall.	Yield p.c.
Bournemouth and Poole	£ 1	15	15	3xd	—	5 0 0
Brompton Ordinary	1	8½	8½	28/-	—	5 0 0
Central Electricity 4½% Deb. ...	Stock	—	—	95	+½	4 14 8
Charing Cross Ordinary	1	8½	8½	29/6	—	4 15 0
Chelsea	1	8½	8½	27/6xd	—	5 1 10
City of London	1	10	10	37/6	—	5 6 8
Clyde Valley	1	8	8	32/6	—⅛	4 18 6
County of London	1	7	10	46/3	—	4 6 5
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	48/-	—	4 11 7
Kensington Ordinary	1	8	8	39/-	—	4 16 7
Lancs. Light and Power	1	7½	7	34/-	—	5 16 8
London & Home Counties 4½% Deb.	Stock	—	—	95½	+½	4 14 9
London Electric	1	8½	9	34/-	—	5 5 11
Metropolitan	1	9	10	40/9	—	4 18 1
Midland Counties	1	6½	7	28/-	—	5 0 0
Mid. Elec. Power	1	15	8	28/9	—	5 11 4
Newcastle-on-Tyne Ordinary ...	1	6	6	22/6	—	5 6 8
do. 7% Pref.	1	7	7	27/-	—	5 3 8
Notting Hill 6% Pref.	10	6	6	11½	—	5 6 8
North Met. Elec. 6% Pref. ...	1	6	6	24/-xd	+6d.	5 0 0
St. James' and Pall Mall	1	8	8	38/6	—	4 18 0
Scottish Power	1	8	8	29/6	—	5 12 9
South London	1	8½	8½	32/-	—	5 0 0
Urban Ordinary	1	7	7	28/9	+⅛	4 17 6
Westminster Ordinary	1	8½	8½	38/6	—	4 18 1
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	35/-	—	6 0 0
Yorkshire Elec.	1	8	8	32/6	—	4 18 6

HOME RAILS

Central London Ord. Assented ...	Stock	4	4	77	—	5 4 0
Metropolitan	,,	4	8½	52½	−1	6 13 4
do. District	,	5	5	74½	—	6 14 3
Underground Electric	£1	8	8	22/-	+6d.	7 5 6

TELEGRAPHS AND TELEPHONES

Anglo-Am. Tel. Pref.	Stock	6	6	103xd	+½	5 16 5
do. Def.	,,	1½	1½	25½	—	5 16 5
Automatic Telephone	1	12½	12½	35/-	—	6 13 4
Cables & Wireless 5½% Pref. ...	Stock	5½	5½	57½	−4	9 11 4
do. A 7½% Ord.	,,	Nil	—	17⅜	−3½	... ...
do. B Ord.	,,	Nil	—	11	−1½	... ...
Globe Tel. and T. Ord.	10	10	—	11	—	... ...
do. do. Pref.	10	6	6	10½	—	5 15 8
Great Northern Tel.	10	20	20	30	+½	6 13 4
Marconi-Marine	1	15	15	36/3	—	8 5 6
Oriental Telephone Ord.	1	12	12	2¾	—	*5 1 0

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	—	1¼	−¾	... ...
do. do. 2nd Pref. ...	5	6	—	12/6	−2/6	... ...
do. do. 5% Deb. ...	Stock	5	5	80½	−2	16 8 0
British Electric Traction Def. Ord.	,,	5	5	1825	—	... ...
do. do. Pref. Ord.	,,	8	—	131½	—	6 1 0
Brazil Traction	100	8	—	19	−2½	... ...
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	97½	—	5 3 1
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/6	—	... ...
London United Tram Deb. ...	Stock	4	4	63½	—	6 6 0
Mexico Trams, 5% Bonds ...	—	5	5	50½	—	9 18 0
Mexican Light Common	100	Nil	Nil	42½	−8	... ...
do. 7% Pref.	100	7	7	70½	−2	9 18 6
do. 1st Bonds	—	5	5	89	+1	6 5 0
Victoria Falls Ord.	1	15	15	58/-	—	5 3 6
Yorkshire (West Riding)		Nil	Nil	5/6	—	... ...

MANUFACTURING COMPANIES

		1928.	1929.			
Assoc. Elec. Ord.	1	6	6	21/6	—	5 11
do. Pref.	1	8	8	27/6	—⅛	5 16 0
Babcock & Wilcox	1	13	15	46/3	−¾	*6 1 3
British Aluminium Ord.	1	10	10	29/9	+6d.	6 14 5
British Insulated Ord.	1	15	15	2¾	−¾	5 9 1
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	2/-	−¾	5 17 6
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	£/-	—	20	1/-	—	7 1 9
do. 8% Pref.	1	8	8	28/-	—	5 14 6
Edison-Swan 1st Pref.	1	7½	7½	28/9	—	6 6 4
do. 5% Deb.	Stock	5	5	94½	—	5 5 10
Electric Construction	1	5½	5	12/6	—	8 0 0
Enfield Cable Ord.	1	20	25	4½	−¾	6 1 1
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	3	Nil	6/3	—	... ...
Ferranti Pref.	1	7	7	21/6	—	6 10 4
G.E.C. Pref.	1	6½	6½	25/6	—	5 3 6
do. Ord.	1	10	14	46/-	−6d.	6 4 5
Henley	1	25	30	5½	−½	5 11 6
do. 4½% Pref.	5	4½	4½	4¾	+¼	5 3 10
India-Rubber	1	Nil	Nil	5/-	—	... ...
Johnson & Phillips	1	10	10	32/6	−4/3	6 10 6
Siemens Ord.	1	7½	7½	1-/-	—	7 1 3
Telegraph Construction	12	10	10	13½	−½	9 5 3

*Dividends paid free of Income Tax.

Registered Electrical Contractors

Annual Report and Meeting of the N.R.E.I.C.

THE report of the Executive Committee of the National Register of Electrical Installation Contractors for the year ended December 31st last shows a surplus of income over expenditure of £492, as compared with £532 in 1929. Applications for registration received during the year totalled 262 (against 238 in 1929). Of these, 122 were accepted (against 139), 69 were declined and withdrawn, and 71 remained under investigation. The net addition to the register was 90, raising the total to 1,380. Since the close of the year this number has risen to 1,411. The total deleted from the Register since its inception was 662, of whom 90 were removed for failing to renew registration. The scheme of displayed advertisements in builders' and architects' journals was continued during the year.

The third annual conference with members of the Council of the Electrical Contractors' Association was held in October last, when matters of mutual interest were fully discussed, including the question of increasing the present annual renewal fee of £1. Subsequently the E.C.A. Council members recommended that an increase should be made. The question of compliance with the I.E.E. Regulations for the Electrical Equipment of Buildings was also considered, and the Committee had adopted a suggestion that a question dealing with this subject should be inserted on the application form for registration, and a similar question should be sent to registered contractors to be answered when applying for renewal of their existing certificates. During the year under review complaints were made against 19 registered contractors. As a result of investigations, four were struck off the Register, one firm withdrew its application for renewal of its certificate, thirteen were cautioned, and one case is still under investigation. In addition, five contractors were removed from the Register for failure to substitute qualifying managers; two of these have since been reinstated. Three contractors were found to be wrongfully making use of the device of the National Register. On investigation, the Committee was satisfied that in two instances there was no intention to mislead, but in the third case the contractor had been struck off the Register and had continued to use the device in his letter paper. A writ was duly issued; the contractor had destroyed all papers bearing the device and had given an undertaking not to make any further use of it. The Committee instructed consulting engineers to carry out inspection of work in five cases, and it proposes to make fuller use of the powers enabling it to authorise these inspections.

At an extraordinary general meeting of members of the National Register convened to consider the question of increasing the annual renewal fee, it was decided that more inspection be made both of applicants' work and that of contractors on the Register. The Committee was therefore instructed to undertake such inspections as it deemed advisable during the year ending April 30th, 1932, the cost to be met out of reserves. The figures for the cost and the effect of these inspections would be available before the end of the year, when the Board could determine a definite figure for the increased renewal fee. The estimated increase necessary was between 10s. and £1.

During the year Wallasey and Portsmouth Corporations decided to restrict work under their assisted wiring schemes to registered contractors, and another Corporation was considering the adoption of a similar course.

The Executive Committee expresses appreciation of the work of the Local Advisory and Scrutinising Committees, and again places on record its thanks to Mr. P. V. Hunter, the chairman, for his able conduct of its proceedings throughout the year.

Mr. H. J. Cash and Col. Edgcumbe, nominated by the I.E.E. and the Illuminating Engineering Society, respectively, have filled the vacancies on the board created by the retirement of Col. Crompton and Dr. Walsh.

Annual Meeting

The annual meeting was held at the Institution of Electrical Engineers on April 24th, Mr. P. V. Hunter (chairman) presiding.

Mr. W. R. Rawlings drew attention to the decline in income, which he said was due primarily to the decrease in the number of new members coming on the Register, and he thought the time was approaching when the revenue would be stabilised. Mr. Hunter pointed out that most of the reputable firms were already on the register and that new members must, therefore, necessarily decrease each year. Mr. F. W. Purse said he did not think that they had reached saturation point. They must not think that 1,400 contractors was the total in this country. He would put the possible number of contractors eligible for registration at 2,000. Mr. Hunter stated that the number on the Register was satisfactory and from the applications received they had had to reject large numbers. He referred to the conferences with the Council of the E.C.A. and expressed his appreciation of their value, Mr. W. H. Walton agreeing that nothing but good had come from these conferences.

Mr. Walton drew attention to three complaints and pointed out that the Corporation concerned was dissatisfied with the Executive Committee's action in cautioning the contractors complained of. He thought that some penalty should be imposed where the offence was not sufficiently serious to justify the removal of the contractor from the Register. In reply, Mr. Hunter pointed out that at present the Committee had no power to inflict penalties other than removal from the Register, but it was preparing proposals to meet cases of this kind.

Mr. Purse mentioned the reference in the report to the additional Corporations who had decided to restrict work under their assisted-wiring schemes to registered contractors, and suggested that it was apt to mislead as to the total number of Corporations adopting this procedure. He thought the report should be amended to show the total number, whereupon Mr. Calvert proposed that Mr. Purse's suggestion should be extended and that the number of Advisory Committees should be shown. Mr. Hunter stated that there were 123 Advisory Committees, and Mr. Calvert added that they included 300 people working voluntarily over the whole of the country for the Register. Appreciation of the work of the Scrutinising Committee in its difficult task was recorded. The report, as amended, was approved.

Messrs. P. V. Hunter and A. H. Dykes were re-elected chairman and vice-chairman, respectively, Messrs. Bruty and Purse were re-elected to the Executive Committee, and the election of Mr. H. J. Cash and Col. Edgcumbe to the Board was confirmed. Mr. Walton was elected to the Executive Committee to fill the vacancy caused by the retirement of Mr. W. R. Rawlings, who, however, will continue to act as hon. treasurer, and the auditors were re-appointed.

Trade Prospects in Brazil

MR. J. Garnett Lomax, M.C., Second Commercial Secretary at the British Embassy, Rio de Janeiro, has prepared for the Department of Overseas Trade a report on economic conditions in Brazil. (Stationery Office, 3s. 6d. net.)

Brazil has a population of about 40,000,000 in an area of 3,300,000 sq. miles; nearly half of these people live within a radius of 500 miles of the capital—chiefly in the Federal District and the States of Rio de Janeiro and Sao Paulo. The country's principal staple product is coffee, which, in 1929, accounted for £67,300,000 of the total value of exports—£94,800,000. The fall in the price of coffee during the last two years has consequently had a very serious effect upon the economic position of the Republic; indeed, a complete collapse was only averted by the granting of a Government loan to the Coffee Defence Institute. The sterling value of the milreis was forced down from the stabilisation rate of 5 59/64d. to 4 13/16d. in December last. (It is now about 3¼d.)

In October last the existing Government was overthrown and a new Provisional Government was formed which announced a programme of drastic reform. This included rigorous economy in State expenditure; the revision of the tax system with a view to sheltering national production and "abandoning the protection given to industries which do not use national products but serve to increase the cost of living"; and the organisation of a general road and railway plan for the whole country to be executed according to requirements. Mr. Lomax refers to the outmoded customs system now in force and says that the simplification and modernisation of the tariff would remove one of the most serious difficulties in selling to this market. Mention is made of the visits paid to Brazil by the D'Abernon Mission and the Sheffield steel makers' delegation and the importance is stressed of such personal contact to study the needs of the country.

The Import Trade

The fall in the price of coffee and other adverse factors combined in 1930 to reduce the general purchasing power and during the first nine months of the year imports fell by about a third. British trade, however, suffered less than that of the United States and Germany, which is an indication of the relative stability and soundness of our export movement. This is probably to be explained by the fact that British exports are mainly of the "necessity" class, while articles which are less essential are supplied by the United States. Some details of the electrical import trade are given in an appendix to the report and the figures are summarised below;—

	1928.	1929.	Inc. or dec.
	Thousands of £.		
Uninsulated copper wire (electric)	28	22	− 6
Insulated copper wire	85	124	+ 39
Electric cables	182	401	+219
Radio apparatus and accessories ...	86	124	+ 38
Electric lighting apparatus and appliances	1,247	1,697	+450
Lighting carbons	18	21	+ 3
Dynamos and generators	172	281	+109
Flat-irons	12	23	+ 11
Lamps	221	203	− 18
Motors	251	332	+ 81
Transformers	207	382	+175
Insulators	54	90	+ 36

It is noteworthy that in a year when imports as a whole declined to a small extent, electrical purchases showed a substantial increase. The following table shows how the three principal supplying countries shared the electrical trade in 1929.

	Gt. Britain.	U.S.A.	Germany.
	Thousands of £.		
Cables and wires (insulated) ...	277	118	38
Lighting apparatus and appliances	190	794	270
Dynamos and generators ...	18	150	72
Motors	43	116	71
Transformers	54	245	52
Radio apparatus and accessories	3	78	39

A small quantity of cables and motors are supplied by Italy and motors by Switzerland.

Marketing Methods

Mr. Lomax considers that British industry is prone to overlook the possibilities of the Brazilian market. Modern Brazil is in a remarkably undeveloped state, and once a period of real expansion sets in there will be hardly any limit to the demand for imports. It is shown that the total foreign trade per head is less than £5, while that of Argentina is over £35 and of Chile nearly £16. The American manufacturer realises that he must pay for pioneering work and is not easily discouraged by the necessity of expenditure upon advertising and salesmen. As a general rule, it is advisable to open a branch office or to maintain a factory representative to work in conjunction with the local agents. This enables an effective control to be kept on credit policy—a particularly difficult problem in Brazil. In any dealings with Brazilian buyers Portuguese should be employed and all catalogues should be in this language; quotations should be given in the metric system. The distribution system should be arranged to cover the whole market. Close watch should be kept upon the "business indicators" for each district, *e.g.*, coffee stocks and prices in Rio and Santos; cotton and sugar stocks and prices in Sao Paulo and Pernambuco; and exchange rates, &c., in Rio. Heavy credit losses still constitute the chief disadvantage of trade with Brazil. Reliable credit information is difficult to obtain. One reason for American success in the market is said to be the leading part taken by credit associations. Until British and other manufacturers and shippers take this problem in hand and organise their own protection, losses will not be avoided nor will there be any improvement in the tone of the market.

Notes from Canada

(By our Special Correspondent)

Activities in Saskatchewan

ALTHOUGH the Saskatchewan Power Commission, which operates somewhat on the lines of the Hydro-Electric Power Commission of Ontario, only began its work in 1929, it has already accomplished a good deal. Nearly $6½ millions has been invested in power plants and transmission lines; during last year existing plants and equipment in 35 towns were taken over and more than 1,000 miles of lines built through the centre of the province from Moose Jaw to Saskatoon and even beyond. It is interesting to note that the lignite deposits of this province, of which there are estimated to be some 60 thousand million tons, are being uncovered, at a point near to the town of Estevan, by an 8-cu. yd., 425-h.p. electric shovel. The lignite is only about 50 feet below the surface and the deposit is 11 ft. thick. The lignite itself is excavated and loaded into railway trucks by a 1¾-yd. shovel which is also electrically-operated. The Dominion Electric Power Co. buys lignite and generates electric power at a steam-driven plant not far away which it sells to the coal company, the town of Estevan, and other customers.

Electricity from Natural Gas

The daily papers have just announced that a scheme to make use of the enormous gas wastage of the Turner Valley district of the Province of Alberta has been proposed to the Premier of that province by the Hercules Consolidated Mining and Smelting Corporation, of London, England, and that this proposal is to be considered at an early date. It is stated that there are "millions upon millions" of cubic feet of natural gas going to waste daily, and the company, it is said, proposes to invest $10 million at once and ten times that sum eventually. The company intends to generate electricity at a large central station and transmit the power throughout Manitoba, Saskatchewan, Alberta, and British Columbia—and apparently also into the United States. The company is asking for a 99-year lease and wants the Alberta Government to enact legislation compelling all oil operating companies or individuals, whose gas is escaping and not being put to use, to supply it (the company) with such gas at a price to be fixed by or arrived at by the Public Utilities Board and the company. The company would connect the oil wells and the proposed generating station with pipe lines, feeding the gas direct to the power plant. If this scheme goes through it should be a great factor in the industrialisation of the West.

Hydrogen-cooled Generators

A member of the staff of the Westinghouse Electric and Manufacturing Co. recently gave some interesting details concerning the use of hydrogen, instead of air, for the cooling of electric generators, in a paper read before the Toronto Section of the American Institute of Electrical Engineers. It was pointed out that the three most important fundamental properties of hydrogen, which make it more desirable as a cooling agent than air, are: High specific heat, which is about 14 times that of air; low density—about 1¼ times that of air; and high thermal conductivity, which is about six times that of air. This combination of advantages reduces the net temperature rise of the armature copper to about 50 per cent. of that which would obtain in air for the same load on the machine, while the field coil temperature rise is reduced to about 60 per cent. These facts make possible an increase in rating of about 25 per cent. for synchronous condensers. Corona damage is reduced owing to the absence of oxygen, while for the same reason the fire risk is minimised. The temperature rise can be calculated with greater certainty; there is greater freedom from local high temperatures; and it is impossible for dirt to get into the machine because it is essential to make the machine as nearly gas-tight as possible. With regard to the risk of explosion—there can be no explosion if more than 70 per cent. or less than 10 per cent. of hydrogen be mixed with ordinary air. The percentage of hydrogen in these cooling systems is maintained at not less than 95 per cent., and since even at 70 per cent. only burning, not explosion, can occur, air is prevented from entering by maintaining the pressure at slightly above that of the atmosphere. Synchronous condensers, being entirely self-contained, can be completely enclosed, but for turbo-generators a suitable gas-tight seal for the shaft has been developed. For these details I am indebted to *Electrical News and Engineering.*

Rapid Power Development

The Hydro-Electric Power Commission of Ontario has in the past few years made contracts for the supply of power in bulk with various private companies. So rapidly does the Commission's load grow (it doubles in about seven years, and is now well over one million h.p.) that approximately one million h.p. has been thus contracted for as follows:—

Company.	H.p. contracted for.
Gatineau Power Co.	360,000
Beauharnois Power Co.	250,000
MacLaren Power Co.	125,000
Ontario Power Service Corporation ...	100,000
Chats Falls Power Co.	224,000
Total	1,059,000

The Commission, in spite of these large contracts, which are for a term of 40 years, has already issued a warning that there will be a power shortage developing in the province by 1935 unless the project to develop power on the international section of the St. Lawrence River is put in hand without delay.

Electrical Supplies for Turkey

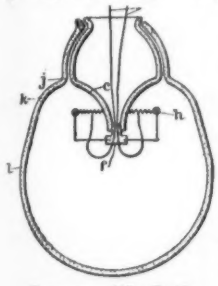
The Department of Overseas Trade has recently prepared a report on the market for electrical contractors' supplies in Turkey for the information of British firms who are desirous of selling this class of goods in that country. It is mentioned that the original electrical concession was granted to a Belgian concern in 1908 and German manufacturers were early in the field. Consequently they now have a firm hold on the market and theirs is the principal competition to be met. Concerns of other nationalities are also active. In spite of this, it is considered that there are many openings for fresh trade. The use of electricity in Istanbul (Constantinople) is continually expanding and as the original installations were of a somewhat primitive character repairs and renewals are constantly necessary. The city is slowly becoming an industrial centre; small factories are being established and these draw their electric power from the town supply. There is scope for further activity in towns which already possess electricity supplies, such as Izmir (Smyrna), Trabzon (Trabizond), Samsun, Adana, and Mersin. Moreover, other centres will establish power stations, and if British manufacturers are to participate in the subsequent development they must do as their competitors have done—arrange regular organisations in Turkey, either by forming Turkish limited liability companies or by more modest methods, such as the appointment of reliable and energetic agents, with technical knowledge, who should be in a position to arrange for sub-agents in every likely locality. The principal points to be observed are: Stocks must be available for immediate delivery; the agents must be authorised to grant credit in accordance with the conditions prevailing in the local market; prices must be competitive; and the agent must possess some technical electrical knowledge. The report also contains a good deal of confidential, detailed information. United Kingdom firms can obtain copies from the D.O.T., 35, Old Queen Street, S.W.1. (Reference A. 10859.)

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Internal-reflector Lamp

In connection with the note in our issue of March 27th last, p. 566, regarding the new Russian incandescent lamp, the feature of which is the fitting within the bulb and above the horizontal portion of the filament of a small reflector, it is interesting to learn that M. J. VAN ECK and M. H. FEKKES, two Dutch engineers, have patented an incandescent lamp with a self-contained reflector. As will be seen from the accompanying drawing, the bulb is of special shape, being parabolic from *j* to *k* and straight from *k* to *l*. The glass reflector *c*, which is silvered and also parabolic, has joined to it by fusion a small glass piece *f* which forms a support for the filament *h*.



Lamp with Self-contained Reflector

The novel leading-in and filament arrangements are worthy of note.

Wall Control for Fans

We learn that the reversible 36- and 60-in. ceiling fans made by the CENTURY ELECTRIC CO., St. Louis, Missouri, can now be supplied with an additional convenience in the form of wall control for the light, and reversing and stopping and starting for the fan. The switch is neat and compact. The fans may be supplied with or without the enclosed lighting fitting suspended in each case below the fan blades.

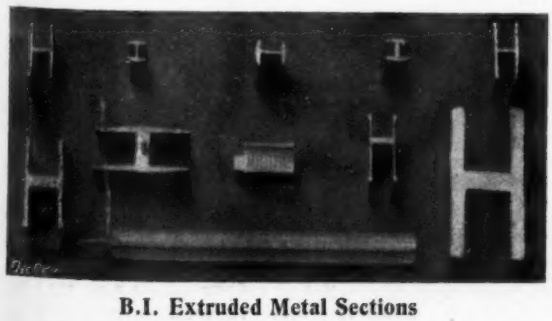
Street-lighting Fittings

DRAKE & GORHAM WHOLESALE, LTD., 77, Long Acre, W.C.2, have recently introduced a range of "Mirolux" street-lighting fittings of which the following are the salient features. By virtue of a solid non-tarnishable steel mirror there is no risk of flaking of the reflecting material. The reflector is very strong and robust, has a greater reflecting value than enamelled iron, and affords uniform distribution of light. An open diffusing glass ring provides the maximum ventilation, adding to the life of the lamp, and preventing dust and insects collecting. The use of "frosted" glass gives the maximum efficiency and compares favourably with the opal or milk-glass type. Dusting out the metal with a wet leather rag affords easy cleaning. It is a very simple affair to exchange the lamps. Light-distribution and foot-candle diagrams show that between 20 and 70 deg. from the vertical, additional light is emitted by mirror reflection. The diffusing glass ring makes the fitting free from glare between 70 and 90 deg., enlightening the surroundings and smoothing out the hard boundary light from bright to dark. This is assisted by the reflection of the inner construction of the glass ring.

A "Mirolux" S.L. Fitting

Extruded Metals

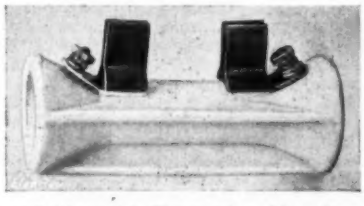
BRITISH INSULATED CABLES, LTD., Prescot, Lancashire, have recently increased their range of extruded metals by producing various new patterns of aluminium mouldings for car body work, copper and lead glazing sections, and zinc rods for the manufacture of primary batteries. An unusual section is one of lead, star shaped and provided with a steel core to give tensile strength, used as the collector in electrostatic dust separators. A recent innovation is the extrusion of glazing sections in a lead-antimony alloy. It is claimed that frames made up of this alloy maintain their shape better and are easier to handle owing to their comparative toughness.



B.I. Extruded Metal Sections

Small Switch and Fuse Gear

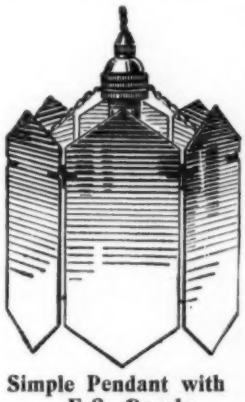
BRITISH INSULATED CABLES, LTD., Prescot, Lancashire, have recently placed on the market several improved types of switches and fuses, including a 15-A ironclad d.p. switch, a 15-A ironclad d.p. switch-cutout, a 60-A, 250-V cutout, and a range of knife switches, all embodying considerable improvements, among which is the use of cadmium-copper for the spring contacts, a material which is tough, springy, and not liable to softening when overheated. In the cut-outs are incorporated a new type of fuse in which the formation of the porcelain provides an expansion chamber for the gases produced on rupture of the circuit. A 60-A, 250-V cutout of the new type has been tested at the National Physical Laboratory; it not only complied with the B.E.S.A. short-circuit test of 4,000-A at 240 V, but it passed a severe test of 4,000 A at 260 V.



Holder with Expansion Chamber

Shade Panels

The accompanying illustration shows a simple, but particularly attractive, lighting fitting constructed with shade panels introduced by FALK, STADELMANN AND CO., LTD., 83 to 93, Farringdon Road, E.C.1. The panels are made in two finishes, obscured and rimpled, and each finish can be obtained in four shades of colour: pink, orange, flame and firelight. These colours and finishes in the glass panels are beautifully blended and toned, giving soft and diffused lighting which is most restful to the eyes and offers harmonious settings to any colour schemes. The panels are adaptable to any modern lighting and are easy to fit; they have no loose parts to get out of order.



Simple Pendant with F.S. Panels

Power-factor Improvement

A new auto-transformer starter for a.c. motors has been developed by the ELECTRIC CONSTRUCTION CO., LTD., 9, Kingsway, London, W.C.2, which has the unusual advantage of improving the power factor of the motor when running. It can be used in place of existing starters, resulting in a saving in cost for electricity where tariffs depend in any way on kVA. It is extremely compact, as will be seen from the illustration, and so requires no extra floor space. The standard arrangement comprises a mild-steel frame suitable for floor fixing, on which is carried the switch (air- or oil-break, depending on the size and fitted with a no-volt release and three overload releases with time lags), the air-cooled auto-transformer, and the condenser. The combination is known as the "Human" system. Tests show that with this gear the power factor of squirrel-cage motors can be raised by 9 per cent. at full load and by 15 to 18 per cent. at half load, depending on the motor speed.

"Human" Air-break Unit

A Large Electro-magnet

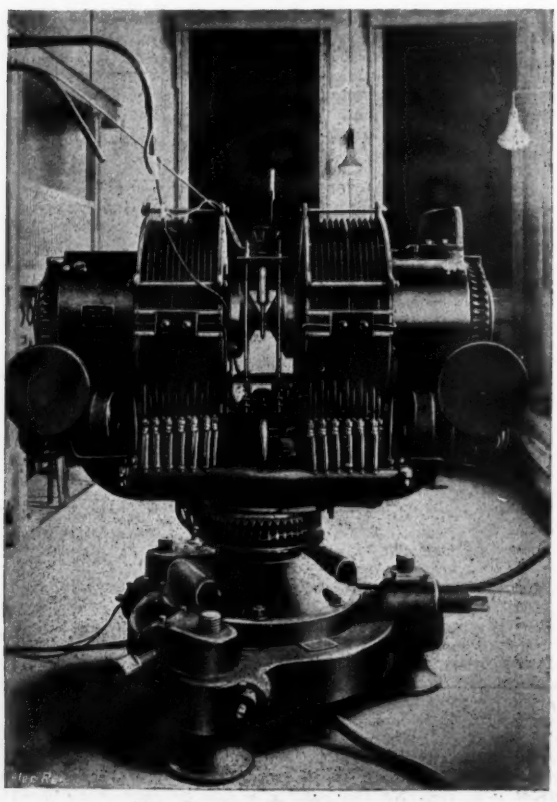
Apparatus has been specially constructed in Germany to facilitate physical research at the Leyden University in Holland

ONE of the trends of physical research has created a need for the production of intense magnetic fields to aid the investigation of natural phenomena. For instance, a typical mode of disintegrating radio-active substances is the expulsion therefrom of an alpha-particle with great energy and velocity in order that its complexity may be analysed in a strong magnetic field, and in his recent Royal Institution lectures Lord Rutherford outlined methods utilised for such investigations and explained how the powerful electro-magnet in Paris designed by Prof. Cotton had enabled an alpha-ray to be deflected into a semi-circle of about 20 cm. radius, thus producing a definite focusing effect.

Working in collaboration with the late Prof. Kammerlingh Onnes, who unfortunately died before it was completed, the Siemens & Halske Co., of Berlin, has recently constructed what is claimed to be one of the largest electro-magnets in the world for research work in the physical laboratory of the University of Leyden in Holland, together with the switchgear, generating plant, and necessary protective devices. The yoke of the magnet is made of high-grade cast steel, special care having been taken to render it free of blow holes. It is supported on a heavy base and is so mounted that, despite its weight of about 14 tons, it can be turned in a horizontal plane by handwheels and worm gearing, while spindles enable the whole magnet to be moved horizontally. The lower structure, a special casting, rests on three supports which are adjustable as to height. The pole cores each weigh about 18 cwt. and their relative positions to each other can be varied from the switchboard by means of small electric motors, or handwheels, which operate worm gearing; they have been made interchangeable to permit poles of suitable shapes to be used according to the particular experiment to be conducted. The magnetic characteristics of the cast steel used for making the yoke, core, and pole pieces are given below :—

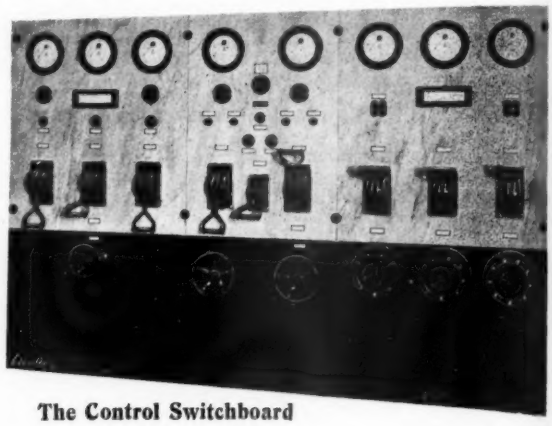
300	ampere-turns	per	centimetre		20,450	Gaus-seconds
200	,,	,,	,,	,,	19,470	,,
100	,,	,,	,,	,,	17,770	,,
50	,,	,,	,,	,,	16,450	,,
25	,,	,,	,,	,,	14,850	,,
10	,,	,,	,,	,,	11,100	,,

The winding consists of 24 component coils having a total weight of approximately 16 cwt. (including the bobbins, about 29 cwt.). Each of the two coils has 500 windings and the maximum load which can be applied to them is 400 amperes at 220 V, the maximum number of ampere-turns being thus 400,000 Exciting energy is derived from three storage batteries, each comprising 68 cells of a capacity of 648 ampere-hours, and/or a 3-phase motor-generator capable of a d.c. output of 60 kW, 520 A, at 115 V, controlled from a distance by a suitable switchboard. Battery regulation up to 80 A is by a finely-graded rheostat and above that value by the cell switches. The voltage of the d.c. generator can be varied from about 10 to 160 V, and the machine is used both for energising the magnet and for re-charging the batteries.



The Leyden Electro-magnet

Owing to the considerable amount of heat generated in the magnet winding, the latter is made of square electrolytic copper tubing, which is cooled by circulating water through it, special automatic safety devices being provided to switch off the current in the event of the failure of the water circulation; the flow of water ranges from 1.5 to 2.3 pints per second at a gauge pressure of 1.8 atmospheres, the latter being, however, variable as desired. As the power fed to the magnet is very high, rising to the maximum of 80 kW, it must not be switched off suddenly without precautions being taken to avoid the disruption of the windings and endangering the lives of the investigators. The system of protection employed includes a resistance that is connected in parallel with the winding when switching off the magnetising current, which is done by means of a push-button switch. The operation is entirely automatic and the parallel circuit is always closed before the automatic switches interrupt the current supply to the magnet. This device limits the magnitude of self-induction and prevents it reaching a dangerous value. When energy is drawn from the batteries the automatic protective system also operates as soon as the pressure drops below 1.8 V per cell to prevent damage to the batteries; in the event of the failure of the water circulation for cooling the excitation winding, the automatic switch is operated by a push-button. For special experiments the electro-magnet can be lifted by a crane into a verticle position, three feet being provided to secure it. Measured with the pole pieces fitted with end pieces 1.8 by 0.8 mm. in diameter and with an air gap of 1.2 mm. a flux density of 66,200 gauss-seconds was obtained, with a magnetising current of 400 amperes and a power consumption of approximately 80 kW.



The Control Switchboard

A Diesel-engined Ship

Messrs. Davey, Paxman & Co., Ltd., recently carried out the official trials of the second of two engine sets, complete with electric generators, which have been made to the order of Messrs. Wm. Denny & Bros., Ltd., Dumbarton, for the motor vessel *Lochfyne*, which in the summer months will run a daily passenger service from Oban, round the Mull, *via* Staffa and Iona, and in winter will run from Gourock to Ardrishaig. The whole installation is of interest by reason of the fact that this vessel will be the first to sail in home waters fitted with Diesel electric transmission, *i.e.*, instead of the engines being coupled direct to the propellor shaft, the two sets of Diesel engines will drive electric generators, supplying two electric motors coupled to the twin screws. The five-cylinder Paxman spring injection engine with an exhaust-driven supercharger is rated at 1,000 i.h.p., at 330 revolutions per minute continuous duty, and has a capacity of 10 per cent. overload for two hours. The bore is 15¾ in., and the stroke 20 in. The supercharger has a normal running speed of 8,600 r.p.m., and the engine is arranged for salt water cooling by independent motor-driven pumps. The main generators are shunt-wound machines, separately excited, of 540 kW normal duty, 500 volts. The exciters, which also serve as auxiliary generators for various electrical requirements on board, are compound-wound machines of the overhung type of 48 kW, at 230 volts. The two auxiliary generators are arranged for parallel operation. The *Lochfyne*, which will carry 1,250 passengers and light cargo, will be 213 ft. long, with a beam of 30 ft. and a draught of 10.5 ft.

The Societies and their Doings

The subjects treated of this week are line-voltage regulation, the hardness and smoothness of deposited copper, overhead-line regulation, and colliery underground uses of electric power

Induction Voltage Regulators

RECENT years have witnessed a rapid growth in the use of induction voltage regulators in this country, which is partly accounted for by the conversion of the older d.c. distribution systems to a.c., partly by the extension and interconnection of existing systems, and also by the fact that bulk supplies are allowed a wider voltage variation than can be passed on by the distributor. One of the outstanding features of such regulators is their adaptability to automatic control under varying conditions and requirements.

According to MR. W. E. M. AYRES, A.M.I.E.E., at the INSTITUTION OF ELECTRICAL ENGINEERS, a 3-phase regulator on a distribution system where it was originally considered doubtful whether voltage regulation was required was found to average 240 operations per day, or over 87,000 per annum. One hesitates to think of the wear and tear, with its attendant maintenance costs, that would result from such frequent operation of switches. The actuating relays for the automatic control of the regulator, however, showed no signs of distress and maintenance costs are negligible. In a works' endurance test one set of automatic gear was subjected to nearly 750,000 voltage impulses without a single faulty operation and with only one cleaning of the relay contacts. Such reliability has only been achieved by the most careful design, choice of materials, and contact loading.

No hard-and-fast rules can be made for the point of application of an induction regulator in a feeder. The technical and financial considerations are so varied that each case has to be worked out on its own merits. However, in general, it is most economical to insert the regulator at the sending end of a feeder, in which position the primary winding is on the incoming constant-voltage side and the primary current has not to be passed through the regulator series windings. The internal kVA capacity of the regulator, and therefore the cost, is reduced. More important, however, is the saving in transmission, as the increased voltage at the sending end means a smaller current to be transmitted for a given kVA received. This may be utilised either as a reduction in transmission losses and in size of regulator, or to cheapen the cost of the transmission line itself. For heavy feeder-drops a balance may be found where the sum of transmission line cost, regulator cost, and capitalised cost of the losses is the minimum. It may be noted also that by increasing the voltage at the sending end the maximum kVA, or "pull-out point," of the line is increased as the square of the voltage, apart from any advantage gained by the smaller amount of reactive kVA transmitted. The line therefore works with better regulation, which may be of considerable importance if the starting of rotating electrical machinery has to be undertaken at the receiving end.

In the typical case considered in the paper the only alternative to the use of an induction regulator was a considerable increase in cable size for the distribution main. It was found that to give satisfactory service within the prescribed limits of voltage allowed this would cost, with laying and reinstatement of roads, approximately £780, whereas the cost of a fully automatic regulator, complete with static balancer and kiosk, was in the neighbourhood of £185, which shows a very great saving in favour of the regulator.

The Mechanical Properties of Copper Deposits

IN the course of a communication from the Research Department of H.M. Woolwich Arsenal to the ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY, MR. A. W. HOTHERSALL recently examined in some detail the factors effecting the smoothness and mechanical properties of electro-deposited copper.

The Brinell hardness range of copper deposited under widely differing conditions from acid copper-sulphate solutions free from organic matter is narrow, the maximum and minimum values obtained being 63 and 38, respectively. This constitutes a disadvantage of such solutions when hard deposits are desired, but a greater drawback is the considerable tendency for the formation of rough and nodular deposits at high current densities. The latter may be caused by the presence in the solution of certain impurities, but in general they are due either to preferential crystal growth on favourably-situated nuclei, or on projecting crystal facets, or to adherence to the cathode of electrically-conducting particles which may thus constitute projecting nuclei.

Once preferential growth of the deposit has commenced, rapid increase in the rate of deposition on the prominent points occurs, especially at the high current densities, owing to the steep potential gradient through the solution. The relatively small increase of polarisation with current density that is characteristic of acid copper-sulphate solutions free from organic matter offers little hindrance to this increased rate of growth. Two methods are available for reducing the tendency, *viz.*, suitable movement of the solution relative to the cathode and the use of addition agents. In practice, the nature and degree of agitation which can be employed are frequently not adequate alone to ensure the formation of relatively smooth deposits, and the use of addition agents has also to be resorted to.

So far as is known, addition agents which effect the production of smooth deposits also increase the hardness and, in some cases, the ductility of the deposit; this is an advantage in cases in which the deposit is required to withstand wear and deformation. No addition agent, however, appears to be available which has an appreciable influence in effecting the production of smooth deposits at high current densities and at the same time does not materially increase the hardness of the deposit. The formation of soft, smooth copper deposits at high current densities remains, therefore, an outstanding problem which can at present only be partially solved by methods for securing adequate movement of the solution relative to the cathode; this limits the maximum rate of deposition according to the type of work which is being carried out.

Examination of the mechanical properties of deposits formed under various conditions in solutions containing different addition agents shows that, of the materials examined, dextrin is probably the least suitable addition agent, as it tends to promote the formation of brittle deposits; gelatin, peptone, and phenol effect a marked improvement in the smoothness and ductility of copper deposits and in increasing their hardness. The effects of gelatin and peptone are very pronounced, so that it is necessary for these materials to be present in small concentrations which cannot at present be satisfactorily controlled. Phenol, however, can be used in concentrations up to 10 *g.* per litre and, as a chemical method is available by which its concentration can be controlled, this substance appears to be eminently suitable for use as an addition agent in acid copper-sulphate solutions.

The Control and Protection of Rural Overhead Lines

AT the April meeting in London of the OVERHEAD LINES ASSOCIATION when the subject considered was the control and protection of rural overhead lines, MR. J. R. HARDING explained that ring mains were commonly sectioned, usually at tapping points, by handle-operated air-break switchgear mounted on a line support, the mains being operated as independent feeders with one of the section switches normally open in order to limit the effect of a fault to one half of the system. Except in the ideal case in which the open switch was located exactly at the point where the maximum voltage drop would occur when the ring was closed, that practice involved a greater drop than that which would occur in a closed ring.

The most satisfactory method of operating was, therefore, to provide fuses on one of the section switch supports, of a quick-acting type and of a rating just sufficient to carry the load of one half of the ring; he was not aware that this method was employed to any large extent. For radiating feeders, provided the tappings and transformers were suitably protected and the main line conductors and supports had a considerable reserve of strength, section-switching points might be kept to the minimum of one per line of ten to fifteen miles long, fed at one end only and protected by an automatic oil switch with a leakage trip coil. If, however, a considerable proportion of the load was supplied before the mid-point of the line was reached, a section switch and a quick-acting fuse near the mid-point would enable a fault at the far end of the line to be cleared without disconnecting the whole line.

Switches of the hand-operated type, as distinct from those operated with a portable rod, should be used exclusively on feeder lines, even when the loading was small. When radiating systems were linked laterally through branches to form, in effect, a series of adjacent ring mains, they should be linked through fuses of low rating. Branch lines, except short ones consisting of conductors of approximately the same size and strength as the main line conductors, should be protected by fuses and handle-operated switches, preferably located on the first poles of the branch lines. When tappings supplied, say, two or three transformers not exceeding 25 kVA each, no additional switches or fuses, other than those controlling the branches, were necessary on the h.p. sides of the transformers and this arrangement was better and frequently cheaper than the provision of isolating links or disconnecting fuses on each transformer pole, provided the location of the switch in the branch was carefully selected. All transformers tapped direct off main feeders, particularly ring mains, should be protected by handle-

operated switches, isolating links or fuses being reserved for small transformers connected to branch lines which could be isolated by hand-operated switches at convenient points.

MR. P. W. LAVERICK said that different terms were often used to describe the same switch and confusion resulted, so that nomenclature should be standardised. There was also needed a far greater degree of co-operation between manufacturers and users; frequently an engineer in the field had to erect switchgear which neither he nor his linesmen had seen before, without blueprints or drawings. When it was remembered that swichgear often arrived on site in sections and had to be assembeled as well as erected, it was not surprising that difficulties arose. Could the cost of the switchgear be reduced any further without the risk of installing apparatus which was likely to do more harm than could result if switchgear were entirely eliminated?

MR. H. TRENCHAM thought that if they could agree how the essential requirements could be met, costs could then be brought down considerably. In the majority of cases a small oil switch or oil circuit breaker would be more efficient and more conveniently fitted than the air-break apparatus now in such common use. Preliminary designs suggested that an 11,000-volt oil switch could be made at a price which would compare favourably with that of air-break switches.

MR. A. ANDERSEN held that surges would have to be considered very carefully before an oil-break switch of the type described by Mr. Trencham could be universally adopted. While a line insulator could usually speedily be replaced, deterioration of switches assumed much greater importance. As little metalwork as possible should be used with porcelain and many troubles had been due to insufficient consideration of the relative coefficients of expansion of metal, porcelain, and cement. There were many insulators on the market to-day which depreciated in the order of 50 per cent. in five years, and switching surges caused this.

MR. J. D. RUDKIN said experiments on the Continent had shown conclusively that the expulsion-type of fuse fitted with silver wire had the most rapid action. Many switches were too cumbersome; the aim should be to reduce metal parts and do away with plasters or cements. Difficulties had been traced to the latter. Efficient and economical surge limiters were now on the market and could be depended upon to act instantaneously.

MR. NUTTALL suggested that the trend of progress would have to be in the direction indicated by Mr. Trencham. He advocated the use of two-storey kiosks as used to a considerable extent on the Continent. They enabled the low-voltage distribution lines to go out overhead without the necessity for underground cables and the high-voltage cables could come in comfortably at one side, thus saving considerable expense. Such kiosks were being made of ferro-concrete and could be erected in a day.

MR. W. FENNELL, chairman, expressed his dislike for anything in the nature of a windlass and wire ropes for bringing a pole fuse to ground level. He could not imagine it being possible to pay £20 for oil circuit breakers for small branch lines.

MR. C. C. NORTH suggested that the O.L.A. should form a Standardisation Committee in the same manner that the Municipal Tramways and Transport Association had done, which body now made drawings and designs available to every manufacturer. He expressed surprise that more had not been said about the magnetic type of fuse, because it was simple and avoided all complexity and insulation troubles.

MR. STEWART said that most switchgear firms well-greased their apparatus before it was put into use, but corrosion occurred mainly in areas where operation was very infrequent. The fault was lack of maintenance.

MR. R. BORLASE MATTHEWS said 11,000-volt switchgear up to, say, 100 amperes was needed most in large quantities, but it received least attention. The operation of rural lines would always have to be in the hands of unskilled men and that fact must be taken into account by switchgear designers. Such lines would necessarily get little maintenance and there must be quick and easy interchangeability, so that if anything went wrong a switch could be replaced and the ineffective one taken to central headquarters for repair. It would pay to adopt switchgear which cost a little more at first so long as it needed less maintenance.

MAJOR T. RICH observed that two methods of eliminating oil from switchgear had been shown at the Leipzig Fair, namely, water and compressed air. Also re-closing gear designed for use with ordinary oil switches was shown there which worked with a winch; a weight was wound up for a certain number of re-closings, purely mechanical and extremely simple, after which the switch was locked out.

MR. JOHN said that with modern cements there was no longer any trouble. A type of fuse which had not been described yet had three distinct operations (quenching material in a cartridge, rapid movement of the cartridge through space, which created an air blast, and direct and powerful ionisation at the severed end) and was being used to a considerable extent on overhead lines. It was not necessary to search for a blown fuse, because it waved its own distress signal; when the fuse went, a spring carried the cartridge back with it.

MR. HARBER expressed the view that the only point against the use of air-break switches was the possibility of the arcs blowing into each other.

MR. J. R. HARDING, in reply, emphasised the need for simplicity, cheapness, and the advantage of a higher capital cost so long as it reduced the costs of maintenance and operation. There was a great tendency to sectionalise lines, but his view was that one switch could be made to do the work hitherto done by two by increasing the distance between them.

The Generation and Uses of Electricity in a Large Colliery

THE methods of producing and utilising electric power in a very large colliery in the Midlands are described in a paper read by MR. E. J. MATHIESON before the London Students' Section of the I.E.E. Generation is at 3,000 volts by means of a 1,875 kVA turbo-alternator, which is sufficient to run the colliery plant and also to light the streets and houses within a radius of six miles. The steam is produced by water-tube boilers, fired with the refuse fuel obtained from the pits. Power is distributed at 3,000 volts by wooden-pole overhead lines to the sub-stations, and underground cables are used to pass under roads and other frequented parts. The houses are supplied on the 3-phase, 4-wire system at 250 volts, the loads being balanced as equally as possible.

In the pits there are five levels, each being interconnected by an electrically-driven retarder consisting of an endless wire rope to which are attached steel disks at regular intervals. The rope runs at a low speed down a wooden steel-lined trough to the lowest level and takes all the mined coal to a common distributing point. This obviates delay which would otherwise be caused in removing the coal from different levels.

Power is led down the shaft by armoured cables to sub-stations where, after being transformed to 600 volts, it is passed to the various haulage engines, pumps, coal-cutters, &c. The sub-stations are solidly built of brickwork as a precaution against damage to the switchgear placed therein.

Cables are slung along the sides of the roads near the roof by "S" hooks at 2-yard intervals. Man-handling, main-and-tail haulage, and self-acting inclines are used where conditions do not warrant the use of pit ponies or electric haulage; the last-named is used whenever possible on account of its cheapness, reliability, and quickness of transport.

Electric haulage by endless ropes is used, with the motors, drums, and gearing in brickwork structures thus protected from damage. The endless wire rope is wound round the drum and circulated through the roads, and tubs are connected to the rope by special clamps which can be quickly disconnected.

Wherever possible, the roads are cut through the actual coal, so that no power is lost in forming the roads, and the inconvenience of removing the slate, debris, &c., is obviated. Arc-wall cutters are used for forming roads; a jib carrying the chain to which the picks are clamped rotates in a semi-circle, thus leaving a cut which, when blasted down, continues the road inwards. Long-wall cutters actually win the coal from the face of the seam; a jib is fixed at right angles to the body of the machine, which drags itself forward on skids along the face of the coal. The depth of the cut is about 6 in., and the length of the jib under the coal varies with the size of the machine; the speed of the rotating chain varies from 200 to 600 ft. per min. Some machines embody ingenious methods of loading themselves on to trucks for quick removal, and others can "flit" from one part of the pit to another under their own motive power. After a cut has been made, the coal is shot down and conveyed away by endless-belt conveyors, jazzers, &c., to the retarder, where it is taken down to the discharge working level; gate-end loaders automatically fill the tubs.

Good ventilation is, of course, essential, and water must be removed continuously from the mine. On account of its trouble-free action, high-voltage generation and distribution without rotary convertors, alternating current is ideal for pit workings. Co-ordination between the miner and electrician will place the British coal industry above its competitors for foreign markets.

MR. R. NELSON officiated as chairman, and a representative body of students from the Institutions of Civil and Mechanical Engineers was present.

During the discussion, the chairman remarked upon the excellent quality of the lantern slides which illustrated the paper, and expressed particular interest in the loader conveyor described. The use of this apparatus made it possible for the coal to be won without being handled by the miner, an ideal that was not reached by one per cent. of the collieries in Great Britain. 28 per cent. of our coal was machine-cut, and there were still 70,000 pit ponies working. In mines risk of shock was intensified, and there were also the dangers of fire and explosion not found on the surface. The best safeguard was the use of earthed metal-clad gear. Another speaker gave the efficiency of good compressed-air coal cutters as 15 per cent. (compared with the 70 per cent. of electricity), costing 1¼d. per 1,000 cu. ft. as against 0.75d. at the face with electricity at 0.5d. per kWh. Under ordinary conditions air compressors required 10.5 kWh at the surface per ton of coal, electric coal cutters only 3 kWh.

The following members and visitors took part in the discussion:—Messrs. Stewart, Eley, Turner, Salter, Haywood, A. N. D. Kerr, Evans, Parson, Irvine, McMaster, Walton.

In his reply the author stated that wood pit props had cost 10d. per ton of coal raised, but channel-steel props with cast-steel heads cost only 2¾d. per ton.

The Eddy-current Rail Brake

Electro-magnetic Action Replaces the Frictional Method for Railway Hump-yard Operations

PERHAPS the most important operation in railway hump-yard working is that of braking the goods wagons, the action usually depending on mechanical pressure being applied to the wagon wheels by either pneumatic, hydraulic, or electrical means. The eddy-current rail brake recently introduced by the Westinghouse Brake & Saxby Signal Co., Ltd., is all-electric in operation and produces a braking effect by virtue of eddy-currents being set up in the wheels when they travel through a strong magnetic field.

The construction of the brake may be best understood by reference to the accompanying drawings. The brake beams

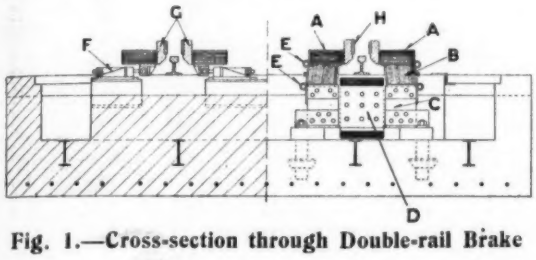


Fig. 1.—Cross-section through Double-rail Brake

A extend the whole length of the retarder and are supported at intervals by the core pieces B resting on the cores C of the electro-magnets D. The beams are not rigidly fixed, but are capable of limited movement towards or away from the running rails, this being made possible by the hinges EE. Springs F constrain the movement and return the beams to their normal position when the brake is unoccupied. The magnet cores are bolted rigidly to the concrete foundation. The poles between which the wagon wheels move consist of bars G normally projecting above the beams. As a small amount of wear in the parts actually in contact with the wheels is inevitable (even though the part played by friction in the braking action is small), separate wearing strips H are attached to the bars in order to make replacement as simple and inexpensive as possible. In order that locomotives may not foul the bars, provision has been made for lowering the bars into a position in which their tops are on a level with the upper surface of the beams. The mechanism shown in fig. 2 is fitted for this purpose. Attached to the bars at intervals are blocks which slide in the sloping guides J fixed to the brake beams, and the raising or lowering is effected by pushing or pulling the bars horizontally by means of a rod K driven by the motor L through gears and the screwed shaft M.

The braking process is achieved without any movement of parts other than the brake beams in adjusting themselves to the slightly varying thicknesses of the wheel tires.

The overall length of the standard retarder is 50 ft., and a double-rail equipment of this length is fitted with twelve magnets, six per rail, mounted horizontally immediately beneath the rail. The windings are impregnated and enclosed in a sealed sheet-metal case filled with sealing compound. Channels are provided in the reinforced-concrete foundation for drainage purposes and for laying the cable. The cores and beams are composed of steel sheets riveted together, while the core pieces consist of plates loosely held together and hinged to both the brake beams and the magnet cores. Although normally the brake is mounted on concrete, if desired a wooden foundation may be used.

When the magnet windings are energised, before the wagon wheels enter the brake, a magnetic flux is set up round the cores through the core pieces and across the gap, tending to draw the brake beams together. The springs F restrain the movement of the beams, and it is only when the wagon enters the brake that the magnetic circuit is completed through the wheel tires. Owing to the change in reluctance of the magnetic circuit, brought about by the substitution of the large air gap by the magnetic material of the wheel tire, there is a tendency for a sudden and great increase of flux. This increase, however, is opposed by the setting up of eddy currents in both the tires and the brake beams themselves, owing to the rotation of the wheels, and it is the interaction between these eddy currents and the magnetic flux that provides the braking effect. It must, of course, be understood that when the wheels enter the brake they are gripped by the brake beams on account of the great magnetic attraction, and a certain amount of friction occurs, about 20 to 30 per cent. of the total force.

The electro-magnets are wound to operate on d.c. at 440 V, the maximum current being about 160 A. The control

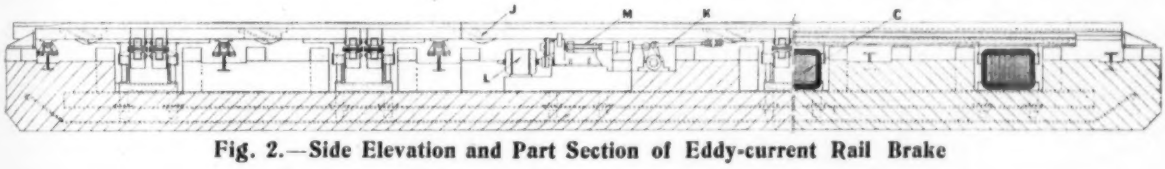


Fig. 2.—Side Elevation and Part Section of Eddy-current Rail Brake

apparatus is very simple, consisting of a sheet-metal desk-type equipment fitted with the retarder control handles, points thumb switches, and the hump-signal control, together with indication lamps, mounted on a sloping panel at such a height that the operator may sit before it with an unobstructed view of the territory over which he has control. This panel may conveniently be laid out in the form of a schematic track diagram of the yard.

The "Ionic Wind" Voltmeter

High-voltage indoor and outdoor precision instruments have been designed, together with portable forms for testing and X-ray apparatus

THE electric "wind" observed in the neighbourhood of a highly-charged point in air is caused by the repulsion of ions produced at the surface of the point by the intense field there. In their movement the ions collide with uncharged molecules of air, thus giving to them velocity and, in effect, causing a "wind" from the point. When the field is alternating this "wind" has two components, a steady stream of air and a movement of alternation in synchronism with the field. The effect is observed at both high-voltage and earthed poles; by enclosing the latter in an insulating vessel and using as the electrode a bent wire with suitable anti-corona shields, the wire is cooled by the alternating component of the "wind," and the cooling is remarkably steady. The effect was investigated by varying the temperature of the wire, the gas pressure in the enclosure, the nature of the gas, and the dimensions of the field, and the law for each of these variants is stated by Prof. W. M. Thornton and Messrs. M. Waters and W. G. Thompson in Vol. 69, No. 412, of the I.E.E. *Journal*. An instrument based on this action, termed an "ionic wind" voltmeter, has been designed to indicate the voltage of any system above a few thousand volts by making the earthed electrode part of a hot-wire bridge. The balance of the bridge is disturbed when the field is applied, and the out-of-balance bridge voltage is a measure of the high voltage, which can be observed at any distance. An indoor form is made to indicate up to 300 kV, an outdoor form up to 132 kV, and portable instruments are available from 3 kV to 150 kV for general testing and X-ray work.

Research has shown the "Wind" to be capable of precision measurement, to be remarkably constant, and to obey laws of a relatively simple kind. It has also been possible to construct a thermo-electrostatic voltmeter based upon the observations made, to measure high d.c. or a.c. voltages, such as are used in power transmission systems. It operates without the intervention of a potential transformer and is capable of being used without loss of accuracy in outdoor stations exposed to all kinds of weather. It can also be used for laboratory or test-room measurements, and is then much smaller for the same line voltage. The range of sensitivity may be varied in several ways, and the instrument can be used to actuate relays by which the line voltage is automatically controlled. Its insulation resistance is made so high by the use of thick porcelain between the live and unearthed parts that the risk from high-potential surges is negligibly small, and one of the risks to which potential transformers are subject is removed by its use.

Grants made by H.M. Department of Scientific and Industrial Research have much advanced the work, while the investigators are indebted to the Newcastle-upon-Tyne Electric Supply Co., Ltd., for testing facilities; to Messrs. Merz & MacLellan, A. Reyrolle & Co., Ltd., and the Cambridge Instrument Co., Ltd., for co-operation; and to the Standard International Corporation and Bitulac, Ltd., for materials used during the research.

Enterprise at Aylesbury

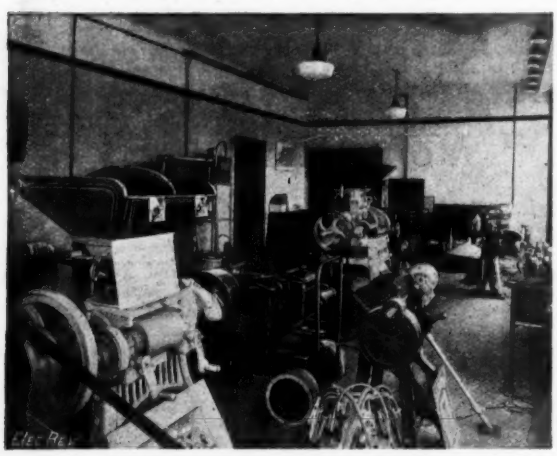
Premier Opens New Showrooms

FOR some years past the Aylesbury Corporation Electricity Department has been known as one of the most progressive of the smaller supply undertakings. As a country town it is particularly concerned with rural electrification and much has been done by the Department in this direction as we have noted in this journal from time to time.

As a further stimulus to electrical development the Department has erected new offices with extensive showrooms and these were opened by the Prime Minister (who happens to be a consumer by virtue of his residence at Chequers) on Friday last.

The new premises are on an ambitious scale judged merely by the size of the town, but having regard to the spirit prevailing in the district there is no doubt that the expenditure will be quickly justified. The style adopted for the Weldon stone-dressed building is in consonance with that of other public buildings in Aylesbury. The whole of the front ground floor consists of showrooms. To the left of the main entrance hall are the agricultural exhibits, while to the right are the domestic and general displays, occupying areas of 600 and 950 sq. ft., respectively. The "agricultural" equipment shown includes incubators, brooders, butter churns, milk separators, mills, chaff cutters, pumps, &c., and among it are three machines loaned by Bull Motors, Ltd. These are a 5-h.p. multi-speed farm motor, totally-enclosed and mounted on a truck, together with its starter; a drip-proof d.c. motor operating in a glass enclosure under a continual spray of water; and an electrically-driven combined crushing and grinding mill. The appliances exhibited in the "general" section are legion—ranging from large-sized cookers down to cigar lighters—and many of the leading makers are represented. Opening out from the main showroom is a series of small rooms (bedroom, bathroom, kitchen, &c.), for the demonstration of particular classes of apparatus. At the rear of the showrooms there is a lecture and demonstration room (580 sq. ft.) and ample stores and garage accommodation. A stone staircase leads from the main entrance hall to the upper floor upon which there are the general offices, a spacious conference room, and the meter department. An electric thermal-storage system is employed in the heating of the building and electric clocks have been installed in every room. The building was designed by Mr. C. N. Quilter (John S. Quilter & Sons) and the electrical installation was carried out by the Department.

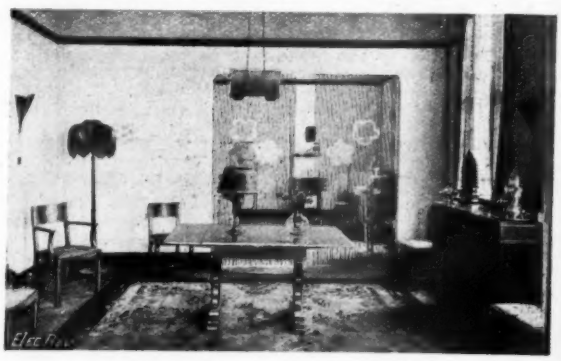
In declaring the building open, Mr. Ramsay MacDonald said that by the electrification of rural areas people would be attracted back to the land and the basis of industry would be widened. After the opening ceremony a dinner (presided over by the Mayor, Councillor F. Standring) was held at the Walton Hall, and every speaker paid tribute to the energy and enterprise of the borough electrical engineer, Mr. W. A. Turnbull. The chairman of the Electricity Committee (Councillor F. Taylor) said that in 1926 it was decided to embark upon a scheme of rural electrification drawn up by Mr. Turnbull. The work was to have been spread over 10 or 15



Agricultural Equipment at Aylesbury

years, but so rapidly had they developed (with the aid of the Unemployment Grants Committee) that the transmission scheme was already completed and hundreds of cottages and a number of works and farms were now receiving a supply. The Prime Minister spoke of the important and revolutionary work which was being carried out by Sir Andrew Duncan and his Board. He urged that the beauty of the countryside should be preserved even if extra expenditure was involved, and promised the Board the Government's wholehearted support. Sir J. R. Brooke (vice-chairman, Electricity Commission) said that the Commission and the Board were aiming at the regeneration of industry through electrification. Aylesbury was one of the leaders in the very difficult and expensive work of rural development. In this work it was necessary to proceed far ahead of the demand and then attract consumers to the supply. He gave the main credit for Aylesbury's rapid electrical expansion to Alderman J. Robinson, a former chairman of the Electricity Committee, and Mr. Turnbull. Viscount Stopford (vice-chairman of the Electricity Committee) said that in Aylesbury electricity was available to every householder and all the street lighting was electric. Mr. Turnbull's "Aylesbury" pole was known throughout the country, as well as in the United States and Canada.

The gathering included many prominent people, including the Lord Lieutenant of Buckinghamshire (Lord Cottesloe), the



Part of the Domestic Display

Bishop of Buckingham, the chairman of the Bucks County Council (Dr. L. H. West), Sir Andrew Duncan, Mr. C. C. Paterson, President I.E.E., Mr. R. W. L. Phillips (chairman of the E.D.A. Council), Mr. W. C. Bexon (chairman of the Overhead Lines Association), and Miss C. Haslett (director of the E.A.W.).

We illustrate the agricultural section of the display, and a part of the general showrooms depicting the dining room and kitchen.

Parliamentary Notes

[By our Special Parliamentary Reporter]

Telephone Development

On April 21st, MR. ATTLEE, the Postmaster-General, moved a money resolution on which to found a Bill, authorising payment out of the Consolidated Fund of a sum not exceeding £32,000,000 for the further development of the postal, telegraphic, and telephonic systems. He said that of the amount asked for, which was for the next three years, all but £2,800,000 was for the telephone service. It was estimated that they had in hand from £1,500,000 to £2,000,000, so that the provision of capital was, roughly, at the rate of slightly more than £11,000,000 per annum. That was an increase of about £1,000,000 a year over the actual expenditure of the past three years. New telephone exchanges accounted for about £9,000,000, underground and overhead lines for £7,000,000, local subscribers for £12,000,000, and sites and buildings for £3,000,000. The amount of capital for a business like the telephone service obviously depended on the rate of increase of custom. From 1925 to 1930 the number of subscribers had increased from 1,390,000 to 1,802,000, or by nearly 50 per cent. Roughly, the net annual intake of new subscribers was about 120,000, after there had been set off those who had discontinued subscribing. The increase in rural telephone exchanges had been very great, and the total number was now 3,366; of these 445 had been opened since 1929. In the same period, 9,000 call offices had been opened. They were in a position to-day to meet a very large intake of subscribers and had about 25 per cent. of spare plant. They were proposing, by advertising and otherwise, to go out for business. It had to be frankly recognised that a loss was made on the rural fringe, but a great deal more could be done to increase the calling rate by developing the "telephone sense."

After some criticism, the resolution was agreed to, and, later, the Bill was brought in.

Wireless-telephony Revenue

On April 20th MR. BOWEN asked the Postmaster-General whether he could state the gross revenue from wireless-telephone services each year since the first service was initiated, the expenditure, and the net surplus.

MR. ATTLEE said that the figures were as follows:—From the commencement of the services on January 7th, 1926, up to March 31st, 1927, expenditure £14,665, revenue £7,504, deficit £7,161; 1927-28, expenditure £64,750, revenue £36,168, deficit £28,582; 1928-29, expenditure £81,803, revenue £114,865, surplus £33,062; 1929-30, expenditure £117,576, revenue £142,932, surplus £25,356. The corresponding figures for the year 1930-31 were not yet available, but owing to the trade depression, combined with the fact that substantial reductions were made in the rates of charge, they would inevitably be less favourable than those of the preceding year.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Yearly Contract Schedules

It is really very surprising the way yearly contract schedules are still issued by some of the corporations and supply authorities of this country. The same printed schedule is used year after year, and any up-to-date estimator knows perfectly well that there is absolutely no possibility of the prices being put before the committee in such a way that the matter will be fairly dealt with. The writer has before him just now a schedule, of which the following are one or two examples :—

"Boxes, cast iron, screwed ⅜ in., ¾ in., and 1 in." The quantity given is 146, and you are asked to fill in an average price and extend.

"Electric bells." The quantity given is 11, and in the one line the price is to be given and extended for sizes from 2¼ in. to 6 in. (no possibility of giving an individual price for each size).

"4,600 yards of screwed welded tubing, ⅜ in., ¾ in., and 1 in." Average price asked to be given per yard.

These are only three of such items in the schedule. It is obvious that with the big difference in the price of each size, &c., asked for, and the fact that the whole is extended at an average price is ridiculous. It is quite well known that such sizes of tube as ⅜ in. and ¾ in. are going to be used, probably in the proportion of ten to one of 1 in., and as regards bells, the 2¼-in. bell can cost 1s. 6d., the 4-in. or 5-in., 10s., while the 6-in. is as much as £1. This schedule is issued by one of the most up-to-date authorities in Scotland.

April 24th, 1931. AN ESTIMATOR.

Adaptable Electric Motors

As the member of a firm engaged in both the mechanical engineering of electric lifts and electric motor manufacture, I wonder if Mr. Graham Ross is altogether fair to the electrical industry.

Rather than emphasise "the enormous increases in selling prices for even small departures from standard," might we not marvel at the enormous decreases in selling prices by the elimination of even small departures from standard? Is he paying an enormous price for his special requirements, or is he perhaps making an enormous saving by avoiding them? In other words, would the production costs in the special electrical department of his own mechanical firm be commensurate with the standard prices or the enormous ones? I think the latter.

A trifling modification in a standardised article introduces the most unexpected contingencies in manufacturing cost. In case No. 13 (carcase minus feet), for example, the increased cost, according to Mr. Ross, practically balances out. If this is true, to what account would the following items be charged, in respect of one motor without feet in the fully specialised shops which to-day exist.

(1) Investigating disturbances to routine before quoting on four such cases, of which one matures to an order.

(2) Covering against those disturbances which may not have been foreseen.

(3) Compensating for the lost ventilation from the holes in the carcase between the feet, or, alternatively, neglecting to compensate and having to rebuild the motor to a new design.

(4) Cutting the stamping key with special setting up in the absence of feet, and presumably on a separate key seater to avoid interference with flow of standard work; preparing the necessary instructions in regard to that setting up.

(5) Ditto in respect of drilling and tapping the eyebolt hole.

(6) Arranging for runway transport instead of roller conveyor travel.

(7) Dispensing with universal carcase holder in the winding department, and providing a special holding arrangement.

(8) Arranging a special bedplate for testing purposes.

(9) Providing trestles in the painting shop.

(10) Issuing special instructions in repacking motors without feet. Cost of crating in place of battening.

(11) Reintroducing additional drawing-office staff, supervisor, cost clerks, requisition routine, materials, lists, &c., which standardisation has eliminated.

If the standard machine costs £15, I do not think that a 50 per cent. increase would be cheering to the cost clerk engaged under item 11.

Keighley, Yorks., *April 22nd*, 1931. R. E. HOPKINS.

The whole of the arguments in Mr. E. Graham Ross's article in the ELECTRICAL REVIEW of April 17th fall to the ground through one consideration—anybody could make motors on the lines he describes, but nobody could sell them. There is no harm, and even much good, in trying to alter existing conditions, but with such a desire too often goes an inability to see things as they are. Motors to-day must be mass produced if they are to sell at ruling prices without the makers going bankrupt, and Mr. Ross's sixteen variables, mostly involving drawing office work or changes in machining, are enough to petrify with fear any up-to-date electrical manufacturer.

Take No. (1)—"Office labour is already provided in every drawing office." That is just what it is not. No commercial motor ever has any drawing office labour done on it once the line is in production; if the labour is there, it is fully occupied in other directions. No. (2), *re* shafts—"Lathe settings are altered." Fifty shafts can be produced for the cost of one new setting. Nos. (11) and (12)—"These affect patterns, *but not to a large extent!*" For a motor to be standard in all respects, but merely to have holes in the feet larger than standard, takes it right out of the normal production line and increases the cost of the *whole machine* five per cent.

Mr. Ross says that "finishing work," whatever that is; "should be done by a squad not normally engaged in standard production. Such men exist in every factory either as millwrights, handymen, or, more important, students." One hesitates to contemplate the feeling of a modern shop superintendent asked to produce his squad of millwrights, handy-men, and students with enough time on their hands to "finish" the output of the factory handed over to them in an "unfinished" condition. Motors to-day are as standardised as galvanised-iron buckets—you can get them in different sizes, but all one shape. Nothing can alter this except a general willingness on the part of the buyers to pay a good deal more, and so I come back to my original contention that anyone could make adaptable motors, but no one could sell them. The buyers whose special requirements Mr. Ross wishes to pander to, by an expensive adaptable machine, are the very people who by their purchasing methods have made the slightest approach to the word "special" utterly impossible. They cannot have their cake and eat it.

April 21st, 1931. STANDARDISATION.

Breakdown Insurances

With reference to this subject, we find that there are insurance companies which do play the game and carry out their obligations, and even go far beyond the obligations as contained in their insurance policies. An insurance policy is a contract between the insured and the insurer but occasionally the insured expects more than he pays for or is entitled to under the terms of his policy.

If "Engineer-in-Charge" will get in touch with a reputable company he will find out exactly what is insurable and it is for him to decide for himself whether it is advisable to insure or not. Generally speaking we have found that it is advisable. If "Engineer-in-Charge" is still in doubt I should be pleased to give him further particulars based on my own experience.

Bradford, *April 24th*, 1931. L. JESSOP.

With reference to the query of "Engineer-in-Charge" on this subject, I can say that he will be well advised to insure the electrical plant for which he is responsible, as the regular inspection service given by a tariff company acts as a very useful "second opinion" on matters of efficiency and maintenance, apart from providing financial security in the event of breakdowns. I think your reader will find that the majority of concerns using power are in favour of insurance, at least that has been my experience, and consider the expenditure a good investment. There are, of course, definite conditions in such a policy, exclusion of wear and tear, &c., but he will have no difficulty when trouble occurs if he has the case fully explained at the outset.

April 25th, 1931. BM/OROK.

I would strongly advise "Engineer-in-Charge" to insure his electrical plant against breakdown, as I can assure him that any reputable insurance company undertaking this class of insurance will "play the game" when the inevitable breakdown occurs. This class of insurance carries with it a quarterly inspection of the plant by a qualified engineer, when any defects likely to lead to a breakdown of the plant are reported to the insured. If your correspondent is interested I should be pleased to give him a few instances of claims met by an insurance company which I think would convince him that "insurance against breakdown" is worth while.

Cardiff, *April 25th*, 1931. C. A. BESLEY.

Leakage Trips on 100-A Circuits

In writing in your issue of April 24th, Mr. Gilbert appears to have overlooked the following facts :

(*a*) The earth-leakage trips regulation first appeared in the 8th Edition of the I.E.E. Regulations issued in 1924; (*b*) the milli-ampere trip to which he refers is a much more recent introduction; (*c*) the last paragraph of the regulation reads—"This device may be set to operate with any prescribed value of the leakage current, provided that such value does not exceed 100 A."

Had the Institution had before it the "insidious current leakage" to which Mr. Gilbert refers, it would undoubtedly have legislated for currents in the order of mA, and clearly so stated. Regarding Mr. Gilbert's contention, I would go so far as to submit that not one automatic switch installed to comply with regulation 94 F. will trip on a leakage current

of 1 A, let alone 10 mA, which latter value is, I understand, considerably in excess of the actual a.c. which has proved fatal on several occasions. Reference to regulation 127 clearly shows that the Institution contemplates conduit and sheath resistance of the order of 2 ohms between an outlet and the intake, so that if a live 200-V cable is put dead on to the sheathing or conduit the maximum current which can flow is, by ohms law, 200/2 or 100 A, and this neglects any resistance existing between the earthing connection at the consumers installation and the supply authority's earth plate.

When the 8th Edition was published in 1924 the Institution apparently held the view that the current which could pass to earth on circuits of less than 100 A capacity, added to the normal circuit current, would blow the fuse or trip the automatic switch before serious overloading and overheating of the conductor could occur. Conversely, for circuits normally carrying currents exceeding 100 A, it was apparently felt that additional current to earth of 100 A might not blow the fuse or trip the automatic switch. For example, a 200-A circuit might be protected by a fuse designed to rupture in one minute with a current of 400 A. If the fault current to earth is limited to 100 A, or even to 50 A, and the normal current is 200 A, the total current which could flow would be 300 A in the one case and 250 A in the other, either of which might, it was apparently felt, lead to overheating. Regarding the question of cost, the figures quoted by me were supplied by a leading British manufacturer for sound and reliable gear that might be safely connected to the London street mains, and which is enclosed in substantial metal cases. Up to the time of writing I have not received any lower estimates from British manufacturers, and have, therefore, assumed, rightly or wrongly, that the figures may be regarded as reasonable.

Although I have stated what I believe to be the reasons for the inclusion of regulation 94 in the 8th and 9th Editions, I have yet to be convinced of its practical necessity, or of the demand of a large section of the electrical men for it.

London, W.C.1, *April 27th*, 1931. R. GRIERSON.

Mr. Grierson is obviously not aware that there is now a suitable type of circuit breaker on the market incorporating a trip coil which will isolate a fault to earth as soon as it reaches a potential of 20 volts and requires only 15 mA to actuate. There is, therefore, no question of the cost of extra-heavy earth wires and no reason why the rule should not stand (as it has its uses); also the cost of such a circuit breaker is no more than one would pay for a good-quality breaker without the protective device.

DRAKE & GORHAM
London, W.C.2, *April 20th*, 1931. WHOLESALE, LTD.

Motor Impregnation

I, like Mr. Dunlap, must express surprise that there can be two opinions regarding the superiority of vacuum-impregnation over the hot-dipping method. I feel that most engineers who have dealt with repair and maintenance work on a large scale and have seen the results of the various methods can have no doubt as to the superiority of vacuum impregnation.

Mr. Wilcox gives cases of hot-dipped windings that have given better service than vacuum-impregnated ones. This is quite possible, but there was, of course, a contributary cause which was not apparent. In most cases this cause undoubtedly will have been the use of an unsuitable varnish, possibly assisted by application of the varnish at an unsuitable consistency for penetration, or inadequate steps having been taken to ensure proper oxidisation after impregnation.

I have examined windings of motors produced by well-known manufacturers and found that in spite of vacuum impregnation and efficient plant, the varnish had not penetrated to any extent, the cotton covering on the wires under the first layer not being even slightly discoloured. The failure was entirely due to the use of an unsuitable varnish.

I agree with Mr. Allen that the science of insulating varnishes is a very complicated one, and I have come to the conclusion that nearly all failures of vacuum-impregnated windings have been due to an imperfect knowledge of the principles involved and the failure to select the particular varnish for the job.

Mr. Wilcox states, as regards hot dippings, that if a winding is allowed to remain in the varnish "for some time after all bubbles have ceased to rise, a very effective impregnation will result." I am curious to know how one is to be sure that all the bubbles have risen, and all the air pockets exhausted, as in my opinion vacuum impregnation is the only way to be sure on this point.

The greening of the copper is due to chemical action other than the presence of moisture, and can easily be overcome by a more complete knowledge of the chemistry of varnishes and the results of incomplete oxidisation.

In conclusion, I would advise those dealing with impregnation work to seek the advice and co-operation of the experts employed by the large varnish manufacturers, which I have found to be so freely given.

Birmingham, *April 25th*, 1931. J. D. RAVENSCROFT.

The School of Electrical Engineering

About 30 or 40 years ago there was an Institute of Electrical Engineering and Mechanics, 12, Princes Street, Hanover Square, W., with Mr. Drugman and Professor Carter as the principals. It is possible that later, before it ceased to function, it was known as the School of Electrical Engineering and Submarine Telegraphy, but of this I am not too certain. I wonder whether any of your readers can confirm this and tell me what ultimately became of the Institute and its records.

It is, of course, likely that the Institute and its records, with its traditions, passed into the safe keeping of one of the existing schools.

Any information on these points would be welcome.

London, W.C.1, *April 21st*, 1931. G. BERTOLI.

David and Goliath

On looking through a recently published list of outputs, costs, and prices of municipal supply undertakings I was struck by the fact that 49 of those in the list had total working costs per kWh as low as, or lower than, those of the undertaking of the largest output, and that there did not appear to be any very direct connection between the working cost and the load factor. These total working costs appear to include everything except capital charges, and in order to mask the effect of individual peculiarities it was advisable to group the undertakings according to their outputs, the basis of grouping being that the largest of each group should bear a constant ratio to the smallest. The 49 undertakings referred to were, therefore, divided into four groups with the following striking result:—

	Group 1	Group 2	Group 3	Group 4
(*a*) Number in group ...	10	20	14	5
(*b*) Average output in millions	16.3	36.9	88.7	298.2
(*c*) Load factor	32.4	31	33.1	34.2
(*d*) Average price	1.19	1.10	1.00	1.17
(*e*) Average working cost ...	.595	.556	.518	.60
(*f*) Capital charges	.595	.544	.482	.57
(*g*) Ratio of capital charges to working cost ...	1.0	.977	.932	.95

Note.—Item (*f*) is actually the difference between items (*d*) and (*e*), but as it consists mainly of capital charges it has been so entitled.

Although only the most economical of the smaller undertakings are included in the above there are sufficient of them to justify the comparison, and the following facts would appear to emerge:—

(1) The improvement in load factor with size of city is, as one would expect, negligible.

(2) The ratio of capital charges to working costs is surprisingly constant.

(3) The first three groups exhibit the anticipated reduction in cost with increase in size, but the last group has actually a higher working cost than even the first.

Is one justified in concluding from the last fact that there is a maximum size of undertaking which can be efficiently managed, and that our largest cities have already exceeded it, or is it due to some perverted form of civic pride which makes a large city consider economy beneath its notice?

Manchester, *April 24th*, 1931. G. L. PORTER.

Use Bakelite

With reference to your leaderette on page 698, I think your unqualified recommendation to use bakelite more extensively is rather too drastic. It is certainly not suitable for situations where it is liable to come in contact with an arc of any description, however *small*, and has given trouble in damp situations. There are many rumours floating about with regard to trouble experienced with bakelite lamp-holders and other wiring accessories. I think it would be interesting if some of your readers who have had actual experience with these little troubles would express their views for general information.

F. R. C. ROUSE, A.M.I.E.E.

London, N.W.11, *April 25th*, 1931.

We are very interested to read the paragraph on the use of synthetic resins, on page 698 of the April 24th issue of your admirable paper, and the observations therein must call for some feeling of gratification on the part of the plastic synthetic moulding industry as a whole. We feel, however, that your exhortation to all and sundry to use "bakelite" is somewhat unfortunate and misleading, and the thought passes through one's mind that the writer of the paragraph is wanting in a true appreciation of the significance and relative importance of the term "bakelite." The paragraph in question would lead the uninitiated to suppose that "bakelite" is a general term, applicable to all synthetic resins, whereas it is well known in the trade that this term is the registered trade name of a phenol formaldehyde condensation product, marketed by a particular concern, and it cannot be construed to embrace a wide range of synthetic resins, with, or without the same chemical bases.

It is interesting to note that there are something like over forty different trade names applicable to one or other of these synthetic resins, and, while one must pay due regard to the efforts of the chemist Baekeland in America, from whose name

the evolution of the term "bakelite" may clearly be traced, one must also not be altogether unmindful of the quite independent research work of British scientists in this particular field. We feel that it is only fair to ourselves and other firms engaged in a most interesting and growing industry that this erroneous impression should be removed, and we trust that you will take an early opportunity of giving similar publicity to the real facts of the case. We should be interested to read the views of other readers on this particular topic.

Liversedge, *April 28th*, 1931. J. E. SAUNDERS,
Sales Manager, Birkbys, Ltd.

Engineering Degrees

With regard to the subject of Engineering Degrees, although the subject has, perhaps, taken a turn in another direction, I should like to thank those correspondents who have given me the benefit of their advice, and perhaps their experience.

To the correspondent who enquired whether I belonged to the I.E.E., I would say that I am a graduate member, but up to the present it has been of no value to me. I have, however, more or less decided on my future policy and am resolved to cultivate acquaintances in the right sphere, and make more use of my graduateship. I have, of necessity, been forced to neglect this side of my life due to lack of time.

If the correspondent from Southsea (who wrote to me privately) would kindly forward his address, I should be very pleased to reply. The letter was unfortunately mislaid, and although remembering the subject matter, I cannot recollect the address.

April 28th, 1931. WORRIED.

Phase Shifters

Can any of your readers tell the undersigned if a 3-phase wound-rotor induction motor can be successfully used as a phase-shifting transformer? Of course, these transformers can be bought, but are relatively expensive, and usually of small output. The purpose for which the above is required is for testing watthour meters and also general instrument testing, requiring changes of p.f. The output required is about 1,000 VA or 1 kVA. The rotor might need rewinding, and some mechanical alterations would also be required. What I chiefly want to know is if there are any serious snags which would crop up, as likely to introduce errors in working, or expense in adapting. Supply is on the 3-ph. 4-wire 50-cycle system at 220/380 volts. A one-to-one ratio would be required. Any information regarding the above would be welcomed.

Cape Town, *April 2nd*, 1931. STUDENT.

Petrol-electric Vehicles

We are interested to see Mr. J. W. Burleigh's letter in your April 24th issue, and would point out that at least three of his assumptions are in error.

First, the "very well-known London Omnibus Company" did not have full knowledge of the performance of other petrol-electric systems, based, of course, on the same general type of chassis and engine power.

Secondly, it is not correct to think of "over-speed" as being the same as "over-drive." Over-speed takes place even with a mechanical free wheel, when the propeller shaft speed exceeds the engine speed; but over-drive is quite a different matter, and entails the ability of the engine power to drive the propeller shaft at a speed considerably above engine speed. Over-drive can only be obtained satisfactorily by an electric transmission without a clutch. Half the 'bus mileage is "over-drive."

Thirdly, while it is interesting to hear about a vehicle that has been tried, it is not so impressive to get his opinion of the proposed vehicle embodying the clutch in the design, because the latter has not been tried by him. Other petrol-electrics with a similar clutch have been tried and found wanting. It would be impossible to get as good a performance for the same weight of equipment, including weight of clutch, and we feel sure that the maintenance cost would be increased by the addition of a clutch.

It would be instructive if a vehicle such as he outlines were actually tried.

T. S. MOTORS, LTD.,
H. K. Whitehorn, *Electrical Engineer.*

Maidstone, *April 27th*, 1931.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1929

31,892. "Thermionic valve signal receiving systems." H. R. Hayden. March 19th, 1929. (345,931.)

32,856. "Signalling systems." Telefonaktiebolaget L. M. Ericsson. October 30th, 1928. (346,016.)

33,139. "High-speed fork regenerating repeater for telegraph systems." Western Union Telegraph Co. August 30th, 1929. (346,017.)

36,987. "Recording of sound waves." M. M. Kahn. November 27th, 1928. (346,018.)

36,388. "Recording or reproducing of sound." M. M. Kahn. November 27th, 1928. (346,019.)

36,418. "Plugs for use with electrical switches or wall sockets and the like." A. E. Watson and W. J. Charles. November 28th, 1929. (345,936.)

39,444. "Electron-discharge devices." Arcturus Radio Tube Co. January 22nd, 1929. (345,942.)

39,458. "Radio antennæ systems." Marconi's Wireless Telegraph Co., Ltd. December 24th, 1928. (346,023.)

39,486. "Electrically conducting coils or windings." I. G. Farbenindustrie Akt.-Ges. December 28th, 1928. (345,944.)

39,614. "Synchronising devices for electric motors associated with television, telephotography, mechanical control from a distance, and like systems." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. December 27th, 1928. (345,964.)

39,670. "Cable installations." General Cable Corporation. January 4th, 1929. (345,947.)

39,708. "Electric torches." J. Smith & Son (Glasgow), Ltd., and R. Grinton. December 30th, 1929. (345,948.)

39,741. "Electron-discharge devices." Standard Telephones and Cables, Ltd., D. G. Coveney, and W. E. Benham. December 30th, 1929. (345,949.)

39,793. "Holders for electric lamps and the like." H. C. Browne and E. A. Sanders. December 30th, 1929. (346,027.)

39,893. "Protection gear for electrical apparatus and particularly for polyphase electric motors." Electrical Apparatus Co., Ltd., and R. H. Barbour. December 31st, 1929. (Cognate application, 28,819/30.) (345,966.)

1930

53. "Electromechanical vibrating relays." Creed & Co., Ltd., R. D Salmon, and H. Clifford. January 1st, 1930. (346,003.)

54. "Electrical signalling systems." Standard Telephones and Cables, Ltd., and R. S. Bone. January 1st, 1930. (346,004.)

55. "Electrical conductors." Standard Telephones and Cables, Ltd (L. van Thyn). January 1st, 1930. (346,005.)

79. "Testing apparatus for totalisators." Automatic Telephone Manufacturing Co., Ltd., L. M. Simpson, and O. A. Pearce. January 1st, 1930. (346,007.)

84. "Electrical connection devices." D. E. Barnett. January 1st, 1930 (346,008.)

160. "Means for suppressing disturbing high-frequency oscillations in an electrical system." Automobile Radio Corporation. January 3rd, 1929. (346,034.)

883. "Brush and contact-rocking mechanism for dynamo-electric machines." J. Stone & Co., Ltd., and A. H. Fildes. January 9th, 1930. (346,042.)

987. "Adjustable pendant fittings or suspensions for electric lights." A. E Mayhew. January 10th, 1930. (346,046.)

1,098. "Braking systems for electric motors, particularly those of hoisting or elevator mechanisms." W. H. Mechling. January 22nd, 1929. (346,048.)

1,161. "Thermionic valves." P. Freedman. January 13th, 1930. (346,050.)

1,295. "Electromedical treatment and electrically stimulating plant growth and industrial chemical processes." A. W. Sharman and F. G. L. Scott. January 14th, 1930. (346,051.)

2,277. "Dielectric testing of the coupling sleeves of high-tension cables." Felten & Guilleaume Carlswerk Akt.-Ges. March 4th, 1929. (346,061.)

3,810. "Electromagnetic coupling devices." Gramophone Co., Ltd., and A. H. Cooper. February 4th, 1930. (346,082.)

4,188. "Device for making variable contact for rheostats, potentiometers, and like apparatus." J. E. Thomas. October 22nd, 1929. (346,065.)

4,298. "Electrical heating elements." Geo. Bray & Co., Ltd., and G. Bray. February 8th, 1930. (346,089.)

4,741. "Electric circuit controllers for traffic signals." British Thomson-Houston Co., Ltd. February 12th, 1929. (346,094.)

4,897. "Electron-discharge tubes or thermionic valves." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 13th, 1929. (346,096.)

7,716. "Electric measuring instruments." J. W. Record and Record Electrical Co., Ltd. March 10th, 1930. (346,124.)

8,448. "Electromagnetic servo-motor." F. Nunes. April 25th, 1929. (346,131.)

8,886. "Electromagnetic relays." Ericsson Telephones, Ltd., and A. G. Rogers. March 20th, 1930. (346,137.)

9,760. "Electric couplings of the lampholder type." J. A. Crabtree. March 27th, 1930. (346,145.)

10,258. "Apparatus for reproducing sound from sound-film records." British Thomson-Houston Co., Ltd. March 29th, 1929. (346,149.)

10,477. "Means for the support of overhead conductors of electric traction systems." British Insulated Cables, Ltd., and J. W. Astley. April 2nd, 1930. (346,151.)

10,593 "Telephone instrument and like supports." W. P. Grafton. April 3rd, 1930. (346,155.)

10,613. "Telephone pay stations." Telephon-Apparat-Fabrik E. Zwietusch and Co., Ges. May 30th, 1929. (346,156.)

10,625. "Ignition systems for internal-combustion engines." K. E. L. Guinness and C. M. Carington. April 3rd, 1930. (346,157.)

10,627. "Variable electrical condensers." Gramophone Co., Ltd., A. G. D. West, and A. H. Cooper. April 3rd, 1930. (346,158.)

11,025. "Electric lighting fittings." General Electric Co., Ltd., and F. Winstanley. April 7th, 1930. (346,164.)

11,458. "Electric metering systems." Associated Electrical Industries, Ltd. April 11th, 1929. (346,169.)

12,210. "Fused-in conductors for electric discharge vessels and the like." Vereinigte Gluhlampen und Elektricitäts Akt.-Ges. May 28th, 1929. (346,179.)

12,773. "Impulse senders for automatic telephone systems or the like." Coventry Automatic Telephones, Ltd., and A. Lyall. April 25th, 1930. (346,184.)

13,667. "Electron-discharge devices." International General Electric Co., Inc. May 3rd, 1929. (346,193.)

14,987. "Acoustic diaphragms." L. Lumière. May 15th, 1930. (Addition to 14,837/30.) (346,205.)

15,893. "Variable electric resistances, inductances, and like instruments." Standard Telephones and Cables, Ltd,, and J. S. P. Roberson. May 23rd, 1930. (346,212.)

16,682. "Electric totalisators." Automatic Telephone Manufacturing Co., Ltd., and L. M. Simpson. December 28th, 1929. (Divided application on 10,072/29.) (345,956.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 22nd :—

Brook (lettering and design). No. 511,543. Class 6. Electric motors.—Brook Motors, Ltd., St. Thomas Road, Huddersfield.

Phœnette. No. 518,870. Class 8. House telephones and transmitters and receivers therefor.—Phœnix Telephone and Electric Works, Ltd., 38, Newman Street, W.1.

Stadionette. No. 520,688. Class 8. Electric dry batteries (not for medical purposes), and radio-telephonic receiving sets.—J. Fabian, 25, Cowper Street, E.C.2.

Columane, No. 521,066, and Columette, No. 521,067. Class 8. Radio-telephonic receiving apparatus.—Westinghouse Electric and Manufacturing Co., East Pittsburgh, U.S.A. (British representative: J. Raymond Shepherd, 2, Norfolk Street, Strand, W.C.2.)

Linconette. No. 519,044. Class 13. Metal goods for use in electric lighting, heating, signalling and power installations. No. 520,658, and Jacette, No. 520,660. Class 50. Same as No. 519,044 above except that the goods are made wholly or mainly of moulded non-current-conducting material.—J. A. Crabtree & Co., Ltd., Lincoln Road, Walsall.

Ganzstar. No. 520,199. Class 13. Ordinary electric incandescent gasfilled and vacuum lamps.—Gustav Ganz & Co., Vienna. (British representatives: Lloyd, Wise & Co., 10, New Court, Lincoln's Inn, W.C.2.)

Hotpoint. No. 517,747. Class 18. Electrical toasting stoves.—Edison General Electric Appliance Co., Inc., Chicago. (British representative: John Gray, Crown House, Aldwych, W.C.2.)

Jiffy. No. 518,749. Class 18. Electric water-heating apparatus.—A. J. Levey, trading as Lee J. Allen Co., 87, Regent Street, W.1.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BARKING.—Clearance scheme, North Street area; U.D.C. surveyor.

BARROW-IN-FURNESS.—Extensions to premises, Plymouth Street, Walney, for the Barrow Co-operative Society, Ltd., Rossall House; R. T. Dockeray, Ltd., builders, Manchester Street.

BOLTON.—Houses, Hall-in-Wood estate (42), and Swan Lane estate (80); borough engineer. Warehouse premises for Sherry, Ltd., Queen Street; Smith & Son, architects, Fold Street

BOURNEMOUTH.—Hotel, Cranleigh Road; Eldridge, Pope and Co., Ltd. Alterations, Hotel Metropole, Holdenhurst Road; Levy & Franks. Extensions, 82, Old Christchurch Road; Timothy White, Ltd. Additions, 'bus and coach station, The Square; Hants. & Dorset Motor Services, Ltd. Junior school, Ensbury Park, and new department at Stourfield school; borough engineer.

BRIGHTON.—Baths, clinic, pavilion, &c., brewery site, West Street; K. M. C. Cross, architect. Alterations, Grand Hotel, King's Road; Brighton Grand Hotel, Ltd. Hotel at the Dyke (£12,000); Clayton & Black architects. Four shops, Whitehawk estate; W. John. Alterations and additions, St. John's school, Briston Road; managers.

CAMBRIDGESHIRE.—Schools, March, Chatteris, Outwell, and Parson Drove, for the county E.C.; director of education, March.

CARLISLE.—School and house at Warwick Bridge for Heskett and Sons; Foden Hemm & Williams, architects, 36, Dale Street, Liverpool.

CASTLEFORD.—Extensions, R.C. schools (£5,000); R. A. Easdale & Son, architects; L. J. Gallagher & Sons, builders.

CHESHIRE.—Schools, Alsager, Odd Rode, Ellesmere Port, and Bebington, for the county E.C.

CLACTON-ON-SEA.—Court room and alterations to police station for the Essex C.C.; J. Stuart, architect, County Hall, Chelmsford.

COLNE.—Extension of Reedyford Hospital (£18,000); board of management.

CONGLETON (Cheshire).—Houses (100) for the T.C.; borough surveyor. Houses (75) for the R.D.C.; surveyor.

CUMBERLAND.—Extensions, Workington secondary school (£25,000), for the county E.C.; education architect, Carlisle.

DARTFORD.—Houses (105), Heath Lane site, for the U.D.C.; surveyor.

DUDLEY.—School, Swan Street, for the borough E.C.; Webb and Grey, architects.

DUNFERMLINE.—Reconstruction of business premises, 9-13, Bruce Street, for S. Warrens.

EDINBURGH.—Houses (184), Niddrie Mains Road, for the T.C.; burgh surveyor.

ESSEX.—School, Wantz Corner, Dagenham, for the county E.C.; J. Stuart, county architect, Chelmsford.

EWELL (Surrey).—Residential hotel (£25,000), Reigate Road, for Copes Taverns, Ltd.

GLASGOW.—New block for the Ear, Nose and Throat Hospital; medical superintendent. Extension of factory, Maxwell Road; Scottish C.W.S.

GODMANCHESTER.—Re-erection of "The Shae," residence (electrically equipped) of Mr. Jenner, Eastfield Park, London, N.W.

HAMPSHIRE.—Schools, Titchfield, Alton (2), Farnborough, Havant, Hardley, New Milton, New Alresford, Bordon, Butlocks Heath, Cove, Lymington, Ringwood, Romsey, and Winchester, for the county E.C.; director of education, Winchester.

HEBBURN (Durham).—Extensions, Council Chambers; Mr. Paterson, surveyor.

HERTFORDSHIRE.—School, Bushey, for the county E.C.; director of education, Hertford.

ILCHESTER (Somerset).—Re-erection of business premises for R. Wilson (£5,000).

IRISH FREE STATE (Dublin).—Additions to Star of the Sea schools at Sandymount; J. P. Wrenn, architect, 64, Merrion Road.

KNOTTINGLEY (Yorks.).—Works for the British Spun Glass and Insulating Co., Ltd.; Jackson Bros.

LANARKSHIRE.—Houses (62), Carfin and Greengars, for the C.C.; P. C. Smith, architect, 13, Clydesdale Street, Hamilton.

LANCASHIRE.—Senior school at Poulton-le-Fylde (£18,540), and extension of Central Council School, Whiston; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

LEEDS.—Business premises, Butt Lane, Farnley; T. Hey and Co., Ltd. Business premises, Harrogate Road; J. Tetley and Sons, Ltd. Premises for Midland Bank, Ltd., Kirkgate; Whinney, Sons & Austen Hall. Telephone exchanges, Adel and Hunslet; H.M. Office of Works, King Charles Street, London, E.C.4.

LONDON (Acton).—Town hall (£104,000); borough engineer. (Barnes).—Hospital extensions for the U.D.C.; surveyor. (Bermondsey).—Clinic, Tower Bridge Road; E. Edwin Davis, architect. Flats and shops, Fort Road and Rotherhithe Street; B.C. works manager. (Camden Town).—Extensions to tube station; London Electric Railways. (Ealing).—Houses (95), Clauson Avenue; C. Peppiatt, Acton. Houses (172) for R. Lancaster & Son; S. H. West, architect, 40, The Broadway. Shops (8) for R. B. Maisland; T. P. Bennett & Son, architects, 41, Bedford Row. Installation of electric lighting at Greenford Library and at extension of Hanwell Library; borough electrical engineer. Fire station, staff quarters, &c., Uxbridge Road, for the T.C.; also two schools for the E.C.; W. R. Hicks, Town Hall. (Fulham).—Dwellings (369) and shops (16) for the B.C.; borough engineer. Buildings, Fulham Road and Garden Row; G. Guy Rogers. (Hammersmith).—Extension, railway works, old depôt site, Church Lane; Underground Railway Co. (Holborn).—Residential buildings, Malet Street, for women students at the London University (£73,000). (Lee).—Reconstruction of premises, corner of High Road and Lewis Grove; Dubois, Ltd. (Leyton).—Additions and alterations to Sybourn Street school for the B.C.; J. H. Jacques, 61, West Ham Lane, Stratford, E.15. (Rotherhithe).—Extensions to 41-3, Tower Bridge Road; Midland Bank, Ltd. (West Ham).—Public baths for the T.C.; borough engineer.

MANCHESTER.—Additions to mill premises, Buxton Street, London Road, for Hanover Mills Co., Ltd.; Pendleton and Dickinson, architects, 16, Brazennose Street.

MANSFIELD (Notts.).—Extensions, Ransom Sanatorium, for the county C.C.; L. Maggs, county architect, Nottingham.

MARKET DEEPING (Northants).—Re-erection of Picturedrome for W. Soames.

MARKET DRAYTON.—Houses (44) for the U.D.C.; T. Healey, builder.

MARTLEY (Worcestershire).—Houses (70) for the R.D.C.; surveyor.

NEWCASTLE-ON-TYNE.—Rebuilding of business premises, Grangewood Street; S. Eastern, Ltd., Milburn House.

NORTH RIDING.—Extensions, Morris Grange Sanatorium, Middleton Tyas, for the C.C.; county architect, Northallerton.

NORTH SHIELDS.—Primitive Methodist Church and meeting hall; Hawksley Lane; W. H. Browse, contractor, Church Way.

NORTHUMBERLAND.—Police station and court house at Alnwick, and houses for police at Monkseaton, for the C.C.; W. W. Tasker, architect, 17, Claremount Place, Newcastle-on-Tyne.

OLDHAM.—Congregational church at Busk; Winder & Taylor, architects, 61, Union Street.

PENZANCE.—Re-erection of marine engineering works, Wharf Road, for J. H. Slade & Co.

READING.—Smallpox hospital (£7,000) for the T.C.; borough surveyor.

REIGATE.—Two observation wards, Earlswood Isolation Hospital, for the Joint Hospital Board; Vincent Hooper, architect, 67, High Street. School (200 places) for the borough E.C.; director of education.

ST. ALBANS.—Houses (40), Stimpson, Lock & Vince, architects, 173a, High Street, Watford.

SOUTH BENFLEET (Essex).—Rebuilding and extending "The Hoy" inn; Pavey & Co., builders, Southend-on-Sea.

SOUTHEND-ON-SEA.—Winter garden (£60,000) for a local syndicate; particulars from the mayor. Extension and equipment of institution laundry (£8,750) for the T.C.; borough engineer.

SPENBOROUGH (Yorks.).—Two schools for the E.C.; director of education, Cleckheaton.

STAFFORDSHIRE.—Three senior schools, Stafford (£43,000), for the county E.C.; director of education, Stafford.

STOCKPORT.—Houses (70), Hempshaw Lane and Nangrieve Road; borough engineer. Cinema, Buxton Road, Davenport, and new factory, Didsbury Road, Heaton Norris; C. Hartley, architect, 128, Buxton Road.

STOURBRIDGE.—Extensions, Corbett Hospital (£24,000); Martin & Ward, architects, Birmingham.

SUNDERLAND.—Baths (£31,500); borough engineer. Presbyterian church, Grangetown; J. & W. Lowry, contractors, Corporation Street, Newcastle-on-Tyne.

SURREY.—Boys' secondary school, Richmond, for the county E.C.; W. W. Finny, secretary, Kingston-on-Thames.

TIVERTON (Devon).—Installation of electric lighting at isolation hospital for the R.D.C.

TYNEMOUTH.—Additions, Collingwood Arms, Chirton; Newcastle Breweries, Ltd. Primitive Methodist chapel and school, Hawkeys Lane; W. Stockdale, architect. Additions, European and United States Hotel, Railway Terrace; A. Arrol & Sons, Ltd.

WARRINGTON.—Reconstruction of Pelican Hotel, Buttermarket Street; Greenall, Whiteley & Co., Ltd.

WARWICK BRIDGE (Cumberland).—School, Heskett & Sons, architects, Penrith.

WEST RIDING.—School, Darfield, for the county E.C.; director of education, Wakefield.

WHITBY.—Houses (52), Gallows Close estate, for the U.D.C.; surveyor. Shops (10) for J. Stanway; H. Davies, architect, Manchester.

WORCESTERSHIRE.—Senior schools, Halesowen Hill, Cradley, Stourbridge, and Upton-on-Severn, for the county E.C.; director of education, Worcester.

WORTHING.—Joint aerodrome, Shoreham (£50,000); Worthing, Hove and Brighton Councils.